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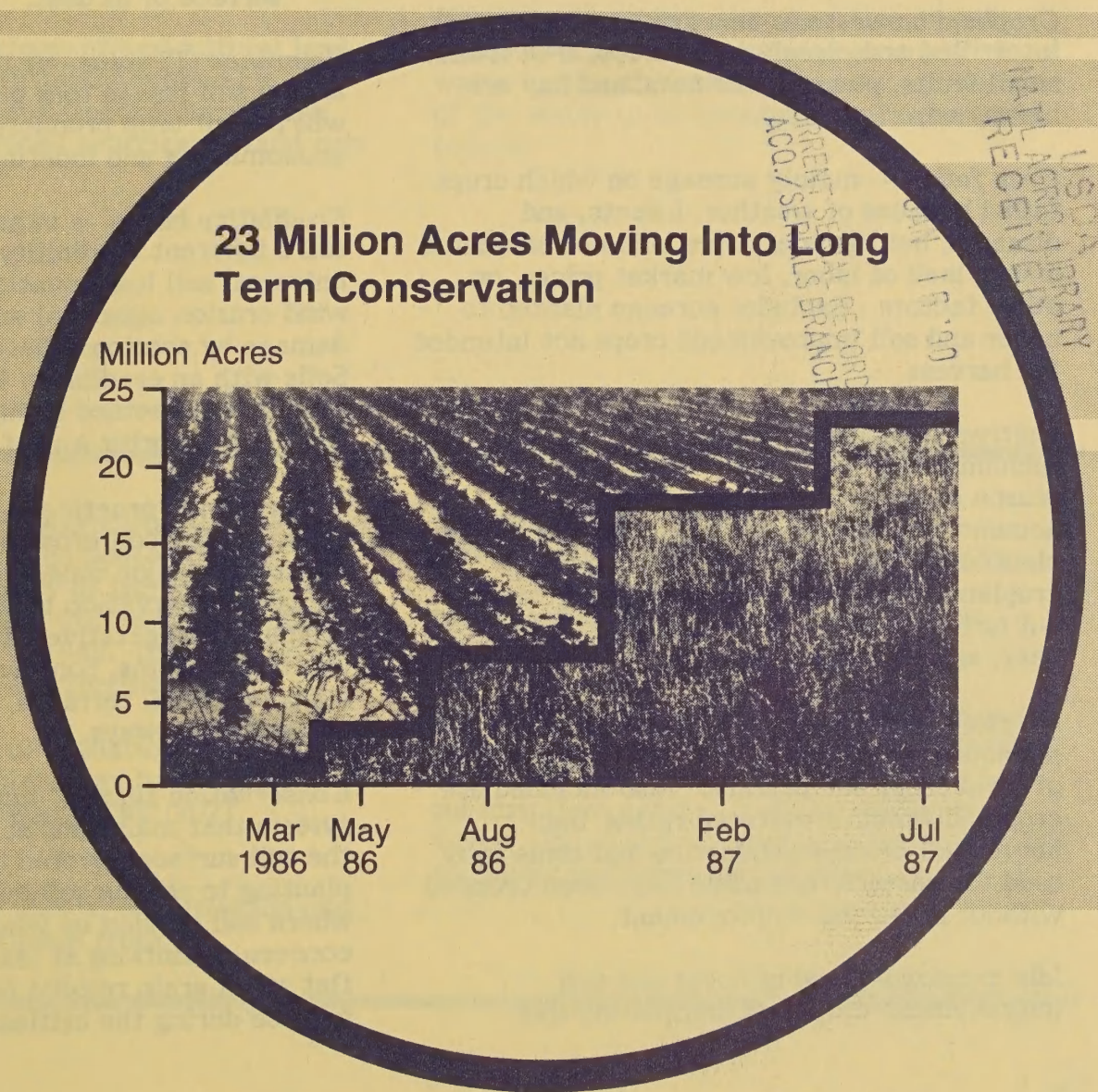
Cropland, Water, and Conservation Situation and Outlook Report



INTRODUCTION

This report presents reference information on cropland, agricultural water use, and soil conservation. The Nation's agricultural output depends heavily upon the acreage devoted to crops, the inherent productivity of the soil, and the amount of water and other inputs applied. Changes in cost–price relationships, competing uses for land and water, and Federal programs cause adjustments in cropland, water use, and soil conservation.

Cropland Terms Used

Cropland--consists of cropland harvested, crop failure, cultivated summer fallow, cropland used only for pasture, and idle cropland.

Cropland used for crops--cropland harvested, crop failure, and cultivated summer fallow.

Cropland harvested--acreage on which intertilled and closely sown crops, tree fruits, small fruits, planted tree nuts, and hay are harvested.

Crop failure--mainly acreage on which crops failed because of weather, insects, and diseases, but includes some land not harvested due to lack of labor, low market prices, or other factors. Excludes acreage planted to cover and soil improvement crops not intended for harvest.

Cultivated summer fallow--cropland in subhumid regions of the West cultivated for a season or more to control weeds and accumulate moisture before small grains are planted. Other types of fallow, such as cropland planted to soil improvement crops but not harvested and cropland left idle all year, are excluded.

Cropland used only for pasture--land currently in pasture as part of a long term crop rotation of field crops and pasture. Also included are cropland which is pastured rather than harvested for crop production and some land used for pasture that could have been cropped without additional improvement.

Idle cropland--land in cover and soil improvement crops and completely idle cropland. Includes acreage idled under Federal acreage reduction programs.

Conservation Terms Used

Erosion--the process in which water or wind moves soil from one location to another. Types of erosion are:

Sheet and rill--when rainfall or irrigation water runoff causes a general washing away of a thin uniform sheet of soil, or the removal of soil in many small channels.

Gully--incisions, too deep to be crossed by farm equipment, cut by concentrated water runoff.

Ephemeral--a water–induced short–lived or seasonal incision, wider, deeper and longer than a rill, but shallower and smaller than a gully.

Wind--erosion by wind along the soil surface or as dust.

Tolerance (T) value--is the maximum rate of annual soil loss in tons per acre per year that will permit crop productivity to be sustained economically and indefinitely.

Erodibility index--a value which combines soil's inherent erodibility (RKLS from the universal soil loss equation or CI from the wind erosion equation) with susceptibility to damage by erosion (tolerance or T level). Soils with an erodibility index of eight or greater are deemed highly erodible lands under the Food Security Act of 1985.

Conservation practices--methods or devices which reduce soil erosion or retain soil moisture. Major conservation practices include conservation tillage (defined below), permanent vegetative cover, cropping or rotation systems, contour farming, strip–cropping, terraces, diversions, and grassed waterways.

Conservation tillage--any tillage and planting system that maintains at least 30 percent of the soil surface covered by crop residue after planting to reduce soil erosion by water; or, where soil erosion by wind is the primary concern, maintains at least 1,000 pounds of flat small grain residue equivalent on the surface during the critical erosion period. No

till is the most restrictive or soil conserving form of conservation tillage. Other conservation tillage practices include ridge-till, strip-till, reduced-till and mulch-till.

Conventional tillage--primary and secondary tillage operations which leave less than 30 percent of the soil surface covered by crop residue after planting.

Water Terms Used

Irrigated farms--farms with any agricultural land irrigated in the specific calendar year. The acreage irrigated may vary from a very small portion of total acreage in the farm to irrigation of all agricultural land in the farm.

Irrigated land--same definition as acres irrigated.

Acre-foot--the quantity of water required to cover 1 acre to a depth of 1 foot. This is equivalent to 43,560 cubic feet or 325,851 gallons.

Acres irrigated--acreage of agricultural land to which water is artificially applied by controlled means. Land flooded during high water periods is included as irrigated land only if the water is diverted to the land by dams, canals, or other works.

Dryland farming--the practice of crop production in low rainfall areas without irrigation by using moisture conserving techniques, such as mulches and fallowing; also called dry farming.

Instream water use--Uses of surface water that do not require diversion of water to a location away from its source. Navigation, hydroelectric power generation and recreational uses are examples of instream water uses.

Offstream water use--water to be withdrawn from it source and transported to another location for use.

Consumptive water use--Use of water resulting in large amounts of evaporation, transpiration, or other losses preventing the water from returning to its source.

Non-consumptive water use--Use of water which does not result in large amounts of water loss to the atmosphere and allows most of the water to be eventually returned to its source.

Approved by the World Agricultural Outlook Board. Summary released September 21, 1987. The next summary of the *Agricultural Resources Situation and Outlook* is scheduled for release January 27, 1988. It will focus on the use of pesticides and fertilizer.

Summaries and full Situation and Outlook reports, including tables, may be accessed electronically. For details, call (202) 447-5505.

The *Agricultural Resources Situation and Outlook* report is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. For ordering and price information, call the GPO order desk at (202)783-3238.

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Situation Coordinator
Merritt Padgitt

Principal Contributors

Cropland:	Roger Hexem	(202)-786-1419
Conservation	Richard Magleby	(202)-786-1435
	Michael Dicks	(202)-786-1407
Water	John Hostetler	(202)-786-1410
	Michael Moore	(202)-786-1410

Resources and Technology Division, Economic Research Service,
U.S. Department of Agriculture, Washington, D.C. 20005-4788

SUMMARY

Cropland used for crops--harvested, failed, and summer fallowed--is estimated at 330 million in 1987, down 27 million acres (8 percent) from 1986. Cropland for harvest is 24 million acres lower, crop failure is down about 3 million acres, and summer fallow acreage is unchanged from 1986. This year's cropland continues a downward trend from a record 387 million acres in 1981, when no cropland was idled under Federal programs. In 1988, crop acreage is likely to decline further as farmers are expected to put more land into the Conservation Reserve Program (CRP).

Farmers idled about 68 million acres under Federal programs in 1987, second only to the 78 million acres in 1983, and 24 million more than last year. Farmers found programs to be attractive and participation was heavy. About three-fourths of the 1987 idled acreage is in annual acreage reduction programs, while the remaining 16 million acres are highly erodible cropland removed from production for 10 years and enrolled in the CRP. An additional 7 million acres have been accepted for the 1988 CRP.

Acreages used for crops in all regions are all down from last year. Largest reductions are expected in the Corn Belt, 9 percent; Northern Plains, 6 percent; Lake States, 8 percent; and Southern Plains, 15 percent. Reductions are closely related to regional increases in acres idled through Federal programs.

Conservation measures installed in 1987 under USDA programs could reduce average annual erosion on treated acres by more than 460 million tons. Of the potential soil loss reductions, about two-thirds result from permanent cover established on acres enrolled in the CRP, while the remainder would come from ongoing technical assistance and cost sharing programs. The 1987 National Resources Inventory now underway will provide data on the additional soil erosion effects from land treatments made without USDA assistance, the removal of installed practices, changes in land use, cropping patterns, tillage systems, and other factors.

Through July 1987, up to 23 million acres of highly erodible land had been signed up for the 10-year CRP. If all signups are accepted, enrollment in the program would be over half the 1990 goal of at least 40 million acres. Farmers and landowners will receive annual rental payments averaging about $43 per acre for the land entering the program in 1986 and $50 per acre for land entering the program in 1987. Permanent vegetation must be established on CRP land with half the establishment cost paid by the Federal Government. Grasses were established on almost 85 percent of the CRP acreage at an average cost of about $80 per acre. Less than 6 percent was planted to trees for about $76 per acre. The remaining acres were either previously in grass or trees, placed into wildlife habitat, or used for windbreaks or other conservation purposes.

Total 1987 USDA expenditures for land and water conservation, including CRP rental payments, are estimated at about $1.5 billion, up 71 percent from 1986. Erosion control expenditures representing over 70 percent of the total, increased substantially in 1987 to cover the CRP rental payments, technical assistance, and cost sharing, some of which will not reoccur.

Farmers who fail to begin implementing approved conservation plans for their highly erodible cropland by 1990 will lose eligibility for most USDA programs under a provision of the Food Security Act of 1985. Among the estimated 118 million acres inventoried as highly erodible, 35 million are currently managed so that erosion is within the compliance standards of the provision and up to 23 million acres have been put in the CRP. This leaves some 60 million acres to be placed in the CRP or treated with approved conservation practices.

Agriculture uses over one-third of all water withdrawn from the Nation's surface and groundwater sources. Over 94 percent of the water used in agriculture is for irrigation, with the remainder used for livestock (4 percent) and domestic needs (2 percent). Groundwater sources provide about one-third of the water for irrigation, 58 percent for livestock and 97 percent of domestic uses.

Although total groundwater withdrawals for irrigation are down from 1980 and earlier

years, declines in groundwater table levels continue in some areas of the country. Consequently, some irrigators are switching to crops requiring less water, adopting water conservation technologies, or converting to dryland farming. Groundwater management continues to be a combination of voluntary and regulatory actions by States. However, proposed legislation may increase the Federal role.

1987–88 OUTLOOK

Cropland used for crops is expected to total 330 million acres in 1987, 27 million below last year and 57 million below the 387–million peak in 1981. Farmers idled about 68 million acres under Federal programs in 1987, 24 million more than in 1986.

Crop acreage will likely continue downward into 1988. Unless U.S. agricultural exports increase sharply, U.S. market prices are likely to be weak. Although target prices for program commodities will be slightly lower in 1988, participation in the 1988 commodity programs is expected to remain high as producers rely on deficiency payments to supplement their returns to production. Also, additional enrollments in the Conservation Reserve Program (CRP) will further reduce acreage in production.

Several provisions of the 1988 wheat program have been announced. Participants must idle 27.5 percent of their base acreage, the same as in 1987, while the 1988 target price will be $4.29 per bushel, down 2 percent from last year. The 1988 loan rate for wheat has been lowered 5 percent to $2.17. Provisions of the feed grain and upland cotton programs must be announced by September 30 and November 1, respectively.

Nearly 16 million acres were under permanent cover in the CRP during the 1987 crop year and through July 1987, another 7 million acres had been signed up to enter the program in 1988. Because it is targeted to highly erodible cropland, the CRP will continue to reduce cropland erosion as well as improve water quality, enhance wildlife habitat, and increase timber production as the program expands toward its 1990 goal of at least 40 million acres. The next CRP sign-up period is scheduled for February 1988.

Total public and private conservation expenditures in 1987 are estimated at nearly $2.6 billion and could expand to nearly $3.4 billion in 1988 with the large increases for the CRP. USDA expenditures for 1988 erosion control could increase by nearly 70 percent to cover rental payments, technical assistance, and cost sharing for the CRP.

CROPLAND

Downward Trend in Acreage Continues

About 330 million acres are expected to be used for crops in 1987, down 27 million acres (8 percent) from last year (table 1). Crop acreage has been trending downward since it peaked at 387 million in 1981. No acreage was idled under Federal programs that year. The subsequent downturn in crop acreage has been mainly due to Federal programs aimed at limiting crop production. Just over 68 million acres have been idled in 1987, 24 million more than in 1986 but about 10 million fewer than in 1983 when the Payment–in–Kind (PIK) and other programs idled 78 million acres.

Farmers intend to harvest 289 million acres of the 19 principal crops in 1987 which together with minor crops may bring total harvested acres to around 301 million. With nearly 9 million acres of the total estimated to be double cropped, harvested cropland is estimated at 292 million acres, 24 million below last year and 59 million below 1981. Because harvesting is still underway in many areas, these estimates may change.

Nearly 32 million acres are estimated to be summer fallowed in 1987, the same as in 1986. Crop failure is estimated at 6 million acres, down significantly from 9 million in 1986 when drought hit several regions, particularly the Southeast and Southern Plains. Failure is lower in 1987 because growing conditions are improved and fewer acres are in production.

Corn Belt Farmers Use 7 Million Fewer Acres

Cropland used for crops is down in all regions from last year. Area in the Corn Belt is expected to total 74 million acres, about 7 million (9 percent) below 1986 (table 2). Corn Belt farmers idled around 6.5 million more acres under Federal programs than in 1986. 1/

Cropland is also substantially lower in the Lake States and the Plains regions. Acreage is down 3 million (8 percent) in the Lake States, while the region's 1986–87 increase in idled acres totaled just over 2.5 million. Producers in the Northern Plains idled 5.5 million more acres than in 1986, but cropland used for crops is down only about 4.5 million. Some producers not participating in Federal commodity programs increased their crop acreages. An opposite situation occurred in the Southern Plains where producers idled nearly 3 million more acres in 1987, but cropland is down proportionately more as close to 5 million fewer acres are being used. The 2-million-acre difference likely represents a net shift from cropland used for crops to other uses in the Southern Plains.

1/ Federal programs to idle cropland are discussed in later sections. Regional acreages of cropland idled are in table 4.

Table 1.--Major uses of cropland, United States 1/

Cropland	1969	1974	1978	1982	1983	1984	1985	1986	1987 2/
				Million acres					
Cropland used for crops	333	361	369	383	333	373	372	357	330
Cropland harvested	286	322	330	347	294	337	334	316	292
Cropland failure	6	8	7	5	5	6	7	9	6
Cultivated summer fallow	41	31	32	31	34	30	31	32	32
Idle cropland	51	21	26	21	3/	3/	3/	3/	3/
Cropland pasture	88	83	76	65	3/	3/	3/	3/	3/
Total cropland	472	465	471	469	3/	3/	3/	3/	3/

1/ Includes the 48 conterminous States. 2/ Preliminary. 3/ Estimated only for years coinciding with a Census of Agriculture.

Source: (1,3,4).

Figure 1
Major Uses of U.S. Cropland

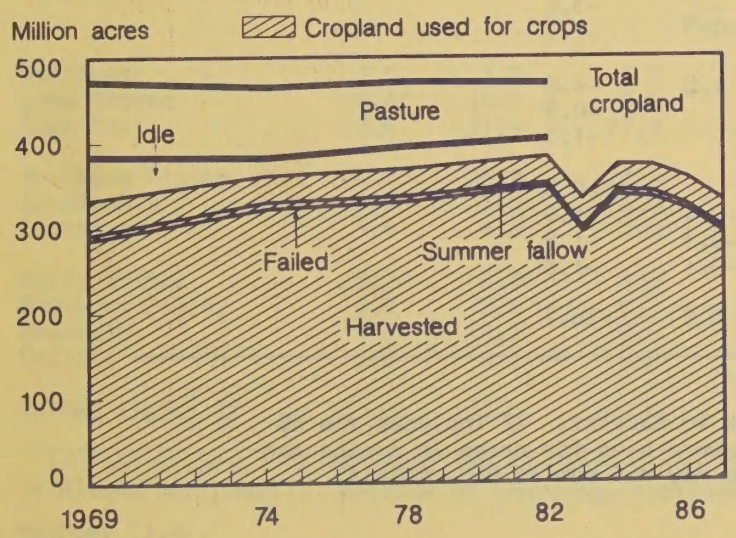
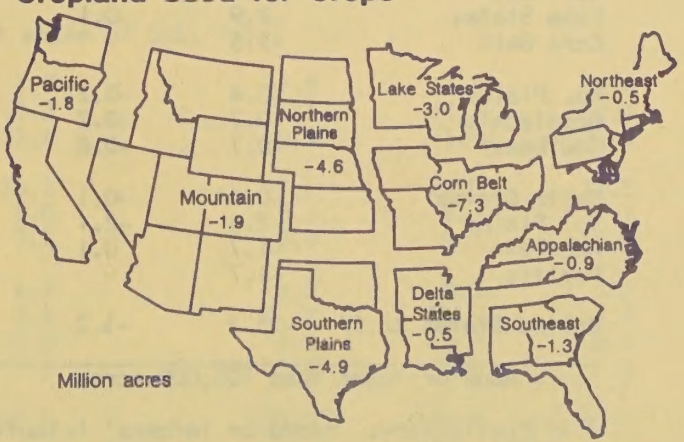


Figure 2
Corn Belt Has Largest 1986-87 Reduction in Cropland Used for Crops



Reductions in other regions ranged from 500,000 acres in the Northeast and Delta States to nearly 2 million in the Pacific and Mountain regions.

The Corn Belt has 27 percent of the 1986-87 national decline and about 22.5 percent of the 1987 cropland acreage. The Northern Plains has just over 26 percent of the cropland but only 17 percent of the 1986-87 decline. The Southern Plains, on the other hand, accounts for nearly 18.5 percent of the decline but only 8 percent of the crop acreage. The differences between the regional shares of 1987 crop acreage and the 1986-87 acreage decline largely result from differing levels of producer participation in Federal acreage reduction programs.

Northern Plains and Mountain Regions Increase Their Regional Shares

During the 1980's, regional shares of cropland used for crops have shifted from southern regions--the Southeast, Delta States, and Southern Plains--to the Northern Plains and the Mountain region. The Northern Plains accounted for about 24 percent of the U.S. acreage in 1981 and 26 percent in 1987 (table 3). The Mountain region increased its share from nearly 10 to 11 percent. The Southern Plains was the big loser with its share declining from about 10 to 8 percent.

Changes in regional shares are closely related to the volume of acres idled and the subsequent number of previously idled acres

Table 2.--Cropland used for crops in 1987 and 1986-87 change, by region

Region	Cropland used for crops 1/				Share of all cropland used for crops
	Cropland harvested	Crop failure	Summer fallow	Total	
	Million acres				Percent
Northeast	12.2	0.1	-	12.3	3.7
Lake States	33.3	0.5	-	33.8	10.3
Corn Belt	73.4	0.6	-	74.0	22.4
No. Plains	68.2	1.4	16.9	86.5	26.2
Appalachia	16.4	0.1	-	16.5	5.0
Southeast	10.1	0.3	-	10.4	3.2
Delta States	15.4	0.2	-	15.6	4.7
So. Plains	24.1	1.4	1.7	27.2	8.2
Mountain	24.5	0.9	10.3	35.7	10.8
Pacific	15.0	0.1	3.0	18.1	5.5
United States 2/,3/	292.6	5.6	31.9	330.1	100.0
	1986-87 Change				
Northeast	-0.5	-	-	-0.5	
Lake States	-2.9	-0.1	-	-3.0	
Corn Belt	-7.3	-	-	-7.3	
No. Plains	-5.4	-0.2	1.0	-4.6	
Appalachia	-0.7	-0.2	-	-0.9	
Southeast	-0.7	-0.6	-	-1.3	
Delta States	-0.4	-0.1	-	-0.5	
So. Plains	-2.4	-2.1	-0.4	-4.9	
Mountain	-1.7	0.1	-0.3	-1.9	
Pacific	-1.7	-	-0.1	-1.8	
United States 2/,3/	-23.7	-3.2	0.2	-26.7	

- = None or fewer than 100,000 acres.

1/ Preliminary. Based on farmers' intentions to harvest. 2/ Includes the 48 conterminous States. Fewer than 200,000 acres were used for crops in Alaska and Hawaii. 3/ Because of rounding, regional acres may not sum to U.S. totals.

Source: (3,4).

returned to production as commodity programs change over time. Acreage changes by nonparticipants in Federal programs also varied among regions.

From 1981, when no cropland was idled under Federal programs, to 1983, when the PIK and other programs were used, acreage idled in the Northern Plains increased nearly 21 million (table 4), but cropland used for crops was down only 9.5 million acres (table 3). Nonparticipants in the Federal programs increased their acreages, and some participants may have increased their acres of nonprogram crops. While crop acreage expanded during 1983–85, the Northern Plains realized 22 percent of the national increase compared with only 17.5 percent of the 1981–83 decline. During the 1985–87 downturn, nearly 9 million more acres were idled in the Northern Plains, but crop acreage was off only 6 million as nonparticipants again increased their acreages. A similar pattern of adjustments occurred in the Mountain region during 1981–87.

Responses and adjustments were quite different in the Southeast and the Southern Plains. The Southeast had 3 percent of the 1981–83 U.S. decline and the Southern Plains had 17 percent, but their shares of the 1983–85 recovery were considerably less at 0.3 and nearly 14 percent, respectively (table 3). Then, during the 1985–87 downturn, an additional 1.5 million acres were idled in the Southeast, but acreage used for crops dropped nearly 3 million. Similarly, an additional 4 million acres were idled in the Southern Plains, but crop acreage was down close to 7 million. From 1985–87, significant acreages of cropland used for crops apparently were shifted to other uses in both regions.

Adjustments in other regions can also be developed from information in tables 3 and 4. Changes in idled acres and in crop acres during

Table 3.--Cropland used for crops and change in acreage, by region

Region	1981	1983	1985	1987 1/	Change 1981–83	Change 1983–85	Change 1985–87
				Million acres			
Northeast	13.6	12.8	13.3	12.3	-0.8	0.5	-1.0
Lake States	40.3	33.8	39.0	33.8	-6.5	5.2	-5.2
Corn Belt	87.5	71.4	85.3	74.0	-16.1	13.9	-11.3
Northern Plains	93.5	84.0	92.6	86.5	-9.5	8.6	-6.1
Appalachia	19.4	16.6	18.7	16.5	-2.8	2.1	-2.2
Southeast	14.8	13.2	13.3	10.4	-1.6	0.1	-2.9
Delta States	19.6	16.2	17.7	15.6	-3.4	1.5	-2.1
Southern Plains	38.0	28.7	34.1	27.2	-9.3	5.4	-6.9
Mountain	38.1	36.3	37.4	35.7	-1.8	1.1	-1.7
Pacific	22.2	20.1	20.7	18.1	-2.1	0.6	-2.6
United States 2/	387.0	333.1	372.1	330.1	-53.9	39.0	-42.0
				Percent share of U.S. total			
Northeast	3.5	3.8	3.6	3.7	1.5	1.3	2.4
Lake States	10.4	10.2	10.5	10.3	12.1	13.3	12.4
Corn Belt	22.6	21.4	22.9	22.4	29.9	35.6	26.9
Northern Plains	24.2	25.2	24.9	26.2	17.6	22.0	14.5
Appalachia	5.0	5.0	5.0	5.0	5.2	5.4	5.2
Southeast	3.8	4.0	3.6	3.2	3.0	0.3	6.9
Delta States	5.1	4.9	4.8	4.7	6.3	3.8	5.0
Southern Plains	9.8	8.6	9.2	8.2	17.2	13.9	16.4
Mountain	9.8	10.9	10.0	10.8	3.3	2.8	4.1
Pacific	5.8	6.0	5.6	5.5	3.9	1.5	6.2
United States 2/	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Preliminary. 2/ Includes the 48 conterminous States. Fewer than 200,000 acres were used for crops in Alaska and Hawaii. Because of rounding, regional estimates may not sum to U.S. totals.

Source: (3,4).

1981–87 corresponded most closely in the Northeast, Appalachia, and the Delta States.

Idled Acreage Increases to 68 Million

Farmers are expected to idle about 68 million acres of cropland in 1987, up nearly 24 million (55 percent) from a year ago (table 4). Farmers have been encouraged to idle more cropland because of a higher acreage set-aside requirement in the 1987 wheat program, an option to idle an additional 15 percent of feed grain base acreages, and weaker market prices but unchanged target prices for most program commodities. Sign-ups for the Conservation Reserve Program (CRP) have also boosted idled acreage. The acreage idled this year is second only to the 78 million idled in 1983, and exceeds the 65 million idled in the early 1960's when the Soil Bank and other programs were underway.

About 77 percent--52.7 million acres--of the 1987 idled acreage is in annual acreage reduction programs, while the remaining 15.8 million acres are enrolled in 10-year contracts to place highly erodible cropland in the CRP (table 5). An additional 7.1 million acres have been enrolled in the 1988 CRP.

Participants in the 1987 feed grain programs (corn, sorghum, barley, and oats) were required to idle at least 20 percent of their base acreages, the same as in 1986, and could idle another 15 percent in the Paid Land Diversion Program. Feed grain acreage idled in the 1987 program totals nearly 29 million, up just over 10 million from last year. In addition, 5.2 million acres of base acreage have been enrolled in the 1986 and 1987 CRP. CRP enrollment amounts to 4 percent of the 1987 feed grain base acreage of nearly 123 million acres.

Participating wheat growers had to idle 27.5 percent of their base acreage, up from 25 percent in 1986. Just over 19 million acres were idled in 1987, about the same as last year. Also, 4.2 million acres (5 percent of the 1987 base acreage) have been enrolled in the 1986 and 1987 CRP.

Acreage set-aside requirements for the 1987 cotton (25 percent) and rice (35 percent) programs are unchanged from 1986. A total of 3.3 and 1.3 million acres of cotton and rice, respectively, were idled in 1987, the same as in 1986. Only 700,000 acres of cotton base and no rice base acreage have been enrolled in the 1986 and 1987 CRP.

Idled acreage was higher in all regions in 1987, particularly in the Corn Belt and the Plains regions (table 4). From 1986 to 1987, an additional 6.6 million acres were idled in the Corn Belt, mostly accounted for by 4 million more corn base acres in the feed grain program and an added 2.4 million acres of cropland in the CRP. One-third of the 5.6-million-acre increase in the Northern Plains resulted from expanded idling of corn and sorghum base acreage and the rest from increased enrollments in the 1987 CRP. The expansion in the Southern Plains largely resulted from more sorghum base acres idled and an additional 2.3 million acres in the 1987 CRP.

CRP acreage increased in all regions during 1986-87. 2/ The Plains regions jointly accounted for about 35 percent of the nearly 14-million-acre national increase, the Mountain region for about 19 percent, and the Corn Belt for 18 percent. Shares in other regions ranged from 0.5 percent in the Northeast to 9.5 percent in the Lake States.

In recent years, acreage reduction programs have become more effective in reducing acreage actually cropped. During 1981-83, an additional 78 million acres were idled nationally, but cropland used for crops was down only 54 million acres. When 47 million fewer acres were idled during 1983-85, crop acreage expanded by only 39 million. In 1986 and 1987, reductions in acres cropped surpassed the increases in acres idled. An additional 13.5 million acres were idled during 1985-86; crop acreage was even lower, down just over 15 million. Similarly, idled acreage increased 24 million during 1986-87 while crop acreage was off about 26.5 million.

Readily Usable Cropland Down

Farmers idling cropland under annual programs can quickly return it to production. A measure of "readily usable" cropland is obtained by adding acreage idled under annual

2/ The CRP is discussed in a later section, "CRP Sign-up Reaches 23 Million Acres."

Table 4.--Cropland idled under Federal acreage reduction programs, by region

Region	1969	1978	1982	1983	1984	1985	1986	1987
				Million acres				
Northeast	1.5	0.2	0.1	1.0	0.1	0.2	0.4	0.8
Lake States	6.4	1.6	0.7	8.0	1.6	2.1	3.9	6.6
Corn Belt	13.0	2.8	1.2	17.9	2.8	3.8	8.2	14.8
No. Plains	15.4	6.9	3.7	20.9	9.4	10.1	13.5	19.0
Appalachia	3.5	0.3	0.1	2.6	0.4	0.5	1.2	2.4
Southeast	3.7	0.3	0.2	2.3	0.5	0.7	1.1	2.2
Delta States	1.0	0.2	0.6	3.5	1.3	1.9	2.2	3.1
So. Plains	7.8	3.4	2.3	12.8	5.7	5.9	6.9	9.8
Mountain	4.4	2.1	1.7	6.1	3.8	3.9	4.8	8.1
Pacific	1.2	0.5	0.6	2.9	1.2	1.6	1.8	3.2
United States 1/	58.0	18.3	11.1	78.0	26.9	30.7	45.0	2/68.5
				Percent share of U.S. total 3/				
Northeast	2.6	1.1	0.6	1.3	0.4	0.6	1.0	1.1
Lake States	11.0	8.9	6.4	10.3	5.8	6.7	8.7	9.4
Corn Belt	22.4	15.2	10.5	22.9	10.5	12.5	18.5	21.2
No. Plains	26.6	38.2	33.3	26.8	35.1	32.8	30.7	27.0
Appalachia	6.1	1.5	1.2	3.4	1.3	1.8	2.7	3.4
Southeast	6.3	1.7	1.4	2.9	1.9	2.3	2.5	3.2
Delta States	1.7	1.0	5.2	4.4	4.8	6.1	5.0	4.4
So. Plains	13.6	18.5	21.1	16.4	21.2	19.2	15.7	14.1
Mountain	7.6	11.4	15.1	7.8	14.3	12.8	10.9	11.6
Pacific	2.1	2.5	5.2	3.8	4.7	5.2	4.2	4.6
United States 1/	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Includes the 48 conterminous States. Because of rounding, regional data may not sum to U.S. totals. 2/ Includes 15.8 million acres enrolled in the Conservation Reserve Program. Another 7.1 million acres are enrolled in the 1988 program. 3/ Developed from unrounded estimates.

Source: (2).

Table 5.--Base acreage idled under Federal acreage reduction programs, United States

Crop	1969	1978	1982	1983	1984	1985	1986	1987
				Million acres				
Corn	27.2	6.1	2.1	32.2	3.9	5.4	13.9	21.1
Sorghum	7.5	1.4	0.7	5.7	0.6	0.9	2.4	3.9
Barley	4.4	0.8	0.4	1.1	0.5	0.7	1.8	2.9
Oats			0.1	0.3	0.1	0.1	0.4	0.9
Wheat	11.1	9.6	5.8	30.0	18.6	18.8	19.8	19.3
Cotton		0.3	1.6	6.8	2.5	3.6	3.4	3.3
Rice			0.4	1.8	0.8	1.3	1.3	1.3
Long-term diversion	7.8						2.0	1/15.8
Total 2/	58.0	18.3	11.1	78.0	26.9	30.7	45.0	68.5

1/ Cropland idled for 10 years in the Conservation Reserve Program. Another 7.1 million acres have been enrolled in the 1988 program. 2/ Because of rounding, crop acreages may not sum to the totals.

Source: (2).

Federal programs to cropland used for crops. Using this concept, U.S. acreage peaked at 411 million in 1983 when about 333 million acres were used for crops and 78 million were idled (table 6). The usable acreage then dropped to 399 million in 1986. So, during 1983–86, about 12 million acres of active and idled cropland were shifted to other uses, 2 million acres of which were enrolled in the 1986 CRP.

Readily usable cropland totaled nearly 384.5 million acres in 1987, down 14.5 million from last year, while CRP acreage increased almost 14 million. About 28 percent of the 1986–87 reduction occurred in the Southern Plains and another 21 percent in the Corn Belt (table 6). Acreages were least affected in the Northeast, Appalachia, and the Delta States, all regions with relatively few acres in the CRP.

The U.S. buildup of readily usable cropland during 1981–83 (24 million acres) was fairly comparable to the 27-million-acre reduction during 1983–87. But, regional shares changed between 1981 and 1987. The Northern Plains accounted for nearly half of the build-up (47 percent) but only 8.6 percent of the downturn, thereby increasing the region's share from about 24 percent in 1981 to around 26.5 percent in 1987 (table 6). The Mountain region also earned a larger share while several regions, particularly the Southeast, Delta States, Southern Plains, and Pacific regions, realized reduced shares.

Crop Acreages Generally Lower in 1987

Harvested acreages of all major crops, except cotton, are expected to be lower in

Table 6.—"Readily usable" cropland and change in acreage, by region 1/

	1981	1983	1986	1987 2/	Change 1981–83	Change 1983–87	Change 1986–87
				Million acres			
Northeast	13.6	13.8	13.3	13.0	0.2	-0.8	-0.3
Lake States	40.3	41.8	40.5	39.0	1.5	-2.8	-1.5
Corn Belt	87.5	89.3	89.2	86.2	1.8	-3.1	-3.0
Northern Plains	93.5	105.0	104.4	102.7	11.5	-2.3	-1.7
Appalachia	19.4	19.2	18.5	18.2	-0.2	-1.0	-0.3
Southeast	14.8	15.5	12.6	11.8	0.7	-3.7	-0.8
Delta States	19.6	19.7	18.2	18.1	0.1	-1.6	-0.1
Southern Plains	38.0	41.5	38.7	34.6	3.5	-6.9	-4.1
Mountain	38.1	42.4	41.9	40.5	4.3	-1.9	-1.4
Pacific	22.2	23.0	21.6	20.3	0.8	-2.7	-1.3
United States 3/	387.0	411.2	398.9	384.4	24.2	-26.8	-14.5
				Percent share of U.S. total			
Northeast	3.5	3.3	3.3	3.4	0.8	3.0	2.1
Lake States	10.4	10.2	10.1	10.2	6.1	10.4	10.3
Corn Belt	22.6	21.7	22.4	22.4	7.3	11.6	20.7
Northern Plains	24.2	25.5	26.2	26.7	46.7	8.6	11.7
Appalachia	5.0	4.7	4.6	4.7	0.8	3.7	2.1
Southeast	3.8	3.8	3.2	3.1	2.8	13.8	5.5
Delta States	5.1	4.8	4.6	4.7	0.4	6.0	0.7
Southern Plains	9.8	10.1	9.7	9.0	14.2	25.7	28.3
Mountain	9.8	10.3	10.5	10.5	17.5	7.1	9.7
Pacific	5.8	5.6	5.4	5.3	3.3	10.1	9.0
United States 3/	100.0	100.0	100.0	100.0	4/ 100.0	100.0	100.0

1/ Includes cropland used for crops plus cropland idled under annual acreage reduction programs but excludes acres in the CRP. 2/ Preliminary. 3/ Includes the 48 conterminous States. Fewer than 200,000 acres were used for crops in Alaska and Hawaii. Because of rounding, regional estimates may not sum to U.S. totals. 4/ Percentage of absolute values.

Source: (2,3,4).

1987, as additional crop acres are idled and enrolled in the CRP (tables 7 and 8).

Even though farmers idled an additional 600,000 acres of cotton base, all in the 1987 CRP, cotton harvested acreage is expected to total 10 million in 1987, up 1.5 million from a year ago. Some nonparticipants in the cotton program increased their plantings. Acreage is higher or unchanged in all regions and particularly higher in the Delta States and Southern Plains.

Harvested acreage for corn in 1987 is estimated at 59.6 million, down 9.6 million from 1986. The lower corn acreage accounts for 40 percent of the drop in all cropland harvested. Corn acreage is anticipated to be lower in all regions, except the Mountain region. During 1986–87, U.S. farmers idled an additional 9.4 million of corn base acreage under Federal programs, 7.2 million in the annual feed grain program and 2.2 million in the 1987 CRP. This slippage between the increase in acres idled (9.4 million) and the reduction in acres harvested for grain (9.6 million) is substantially less than during 1985–86 when an additional 8.5 million base acres were idled, but harvested area was reduced by only 6 million acres.

Farmers are expected to idle 2.5 million more acres of sorghum base in 1987 than last year, including 1 million more in the 1987 CRP. Acres harvested for grain in 1987 are estimated at 10.5 million, down 3.4 million from 1986. Harvested area will likely be lower or unchanged in all regions and particularly lower in the Southern Plains where acreage is off 30 percent.

Wheat acreage in 1987 is estimated at 55.4 million acres, down 5.3 million from a year ago. During 1986–87, farmers idled an additional 3.1 million acres of the wheat base. Harvested acreage is down in all regions except Appalachia and the Delta States, which are expected to show modest increases.

Soybeans are expected to be harvested on 57.6 million acres in 1987, about 1.8 million fewer than in 1986. Acreage is lower or unchanged in all regions except the Northern Plains, where an additional 300,000 acres are expected to be harvested.

Crop Production Per Acre Down in 1986

The U.S. index of crop production per acre was 114 (1977=100) in 1986, down from the record 119 in 1985 (table 9). Drought in portions of eastern and southern regions contributed to the lower index value. Also, per acre applications of fertilizer on corn were down slightly from 1985 while application rates for other major crops were close to 1985 levels. Indices were lower in eastern and southern regions from the Northeast to the Southern Plains. Largest drops were recorded in the Southeast (23 points) and the Delta States (22 points). The index was 8 points higher in the Mountain region as several States, particularly Montana, realized higher yields for wheat, barley, and hay. Indices in other regions were similar to 1985.

Acreage Equivalent of Exports Rebounds

Exports of U.S. agricultural products in fiscal 1987 are forecast at 129 million tons, 17 percent above a year earlier with grains accounting for nearly all of the increase. Lower U.S. loan rates, generic certificates, and the Export Enhancement Program have increased U.S. competitiveness in world markets. Also, higher demand for feed grains in several importing countries together with reduced export stocks among major U.S. competitors have further improved the U.S. position.

The acreage equivalent of the 1987 exports is estimated at 94 million, up nearly 20 percent from last year's 79 million acres (table 10). The 1987 expansion, however, is still substantially below the high of 137 million acres in 1980.

Acreage equivalents represent U.S. export volumes of individual commodities divided by respective per-acre yields. For example, 34 million metric tons of food grains are forecast to be exported during October 1986/September 1987. This volume divided by respective 1986 crop yields results in an acreage equivalent of 35 million. Oil crops accounted for a 26-million-acre equivalent, feed grains for 18 million acres, and cotton for 6 million acres.

Export equivalents in fiscal 1987 are expected to account for 29 percent of all

Table 7.--Change in harvested acreage of major crops 1981-87 and 1986-87, by region 1/

Region	1981-87 Corn	Sorghum	Wheat	Soybeans	Cotton	All cropland harvested	1986-87 Corn	Sorghum	Wheat	Soybeans	Cotton	All cropland harvested
	Million acres											
Northeast	-0.8	-	-0.1	-	-	-1.3	-0.4	-	-0.1	-	-	-0.5
Lake States	-3.3	-	-1.5	0.3	-	-6.5	-1.6	-	-0.6	-	-	-2.9
Corn Belt	-7.7	-0.1	-4.6	-0.1	-	-13.4	-5.1	-0.4	-0.1	-1.0	-	-7.3
No. Plains	-0.5	-0.9	-6.4	1.7	-	-9.0	-1.1	-0.8	-1.4	0.3	-	-5.4
Appalachia	-1.3	-	-1.1	-2.3	0.1	-2.9	-0.7	-0.1	0.1	-0.6	0.1	-0.7
Southeast	-1.4	-	-1.1	-4.1	0.1	-4.2	-0.3	-0.1	-0.2	-0.4	0.1	-0.7
Delta States	0.2	0.3	-1.2	-3.7	-0.1	-4.0	-0.2	-0.4	0.2	-0.1	0.3	-0.4
So. Plains	0.2	-2.0	-4.3	-0.4	-3.2	-10.2	-0.1	-1.4	-1.4	-	0.8	-2.4
Mountain	-0.1	-0.3	-2.6	-	-0.2	-3.3	-	-0.1	-1.0	-	0.1	-1.7
Pacific	-0.1	-0.1	-2.3	-	-0.4	-3.7	-0.1	-	-0.7	-	0.1	-1.7
United States 2/	-15.0	-3.1	-25.3	-8.5	-3.7	-58.5	-9.6	-3.4	-5.3	-1.8	1.5	-23.7

- = None or fewer than 100,000 acres.

1/ Corn and sorghum for grain. All 1987 acreages based on farmers' intentions to harvest. Changes developed from unrounded estimates. 2/ Includes the 48 conterminous States. Because of rounding, regional acres may not sum to U.S. totals.

Source: (5,6).

Table 8.--Harvested acreage of major crops, by region 1/

Region	Corn 1981	Corn 1986	Corn 1987	Sorghum 1981	Sorghum 1986	Sorghum 1987	Wheat 1981	Wheat 1986	Wheat 1987	Soybeans 1981	Soybeans 1986	Soybeans 1987	Cotton 1981	Cotton 1986	Cotton 1987
	Million acres														
Northeast	3.2	2.7	2.4	-	-	-	0.6	0.6	0.5	0.9	0.9	0.9	-	-	-
Lake States	13.1	11.4	9.8	-	-	-	4.5	3.6	3.0	5.8	6.1	6.1	-	-	-
Corn Belt	36.9	34.3	29.2	1.0	1.3	0.9	7.7	3.2	3.1	30.2	31.1	30.1	0.2	0.2	0.2
No. Plains	11.1	11.7	10.6	6.1	6.0	5.2	30.4	25.4	24.0	4.6	6.0	6.3	-	-	-
Appalachia	4.7	4.1	3.4	0.2	0.3	0.2	2.5	1.2	1.4	6.5	4.9	4.2	0.4	0.4	0.5
Southeast	2.8	1.6	1.4	0.2	0.2	0.2	2.0	1.2	0.9	6.2	2.5	2.1	0.7	0.6	0.7
Delta States	0.2	0.6	0.4	0.5	1.3	0.8	2.5	1.2	1.3	11.2	7.6	7.5	2.5	2.0	2.3
So. Plains	1.1	1.4	1.3	4.9	4.2	2.9	12.9	10.0	8.6	0.8	0.4	0.4	7.9	3.8	4.7
Mountain	1.0	0.9	0.9	0.7	0.5	0.4	11.8	10.1	9.2	-	-	-	0.7	0.4	0.5
Pacific	0.4	0.4	0.3	0.1	-	-	5.7	4.1	3.4	-	-	-	1.5	1.0	1.1
United States 2/	74.5	69.2	59.6	13.7	13.9	10.5	80.6	60.7	55.4	66.2	59.4	57.6	13.8	8.5	10.0

- = None or fewer than 500,000 acres.

1/ Corn and sorghum for grain. All 1987 acreages based on farmers' intentions to harvest. 2/ Includes the 48 conterminous States. Because of rounding, regional acres may not sum to U.S. totals.

Source: (5,6).

Table 9--Indices of crop production per acre of cropland used for crops, by region

Year	North-east	Lake States	Corn Belt	Northern Plains	Appa-lachia	South-east	Delta States	Southern Plains	Mountain	Pacific	United States 1/
					1977 = 100						
1969	109	86	93	84	114	113	101	80	92	87	91
1974	106	78	77	77	108	125	100	77	98	97	88
1978	109	102	108	110	109	114	100	88	109	95	105
1979	109	105	116	119	102	120	112	109	107	107	113
1980	104	100	102	92	95	102	81	79	111	113	100
1981	112	106	114	116	118	130	110	106	117	112	115
1982	114	114	117	120	120	133	118	91	116	115	116
1983	104	101	88	102	88	116	98	97	110	114	100
1984	117	110	105	118	116	129	118	100	107	121	112
1985	120	114	124	129	111	134	114	106	103	119	119
1986 2/	107	114	123	131	94	111	92	89	111	118	114

1/ Includes the 48 conterminous States. 2/ Preliminary.

Source: (3).

Table 10--Acreage equivalents of U.S. crops exported, 1970-86

Year	All crops harvested 2/	Used for exports 1/					
		Total	Food grains	Feed grains	Oil crops	Cotton	Other crops
				Million acres			
1970	293	72	25	16	23	4	4
1975	336	100	39	25	26	4	6
1980	352	137	50	34	37	7	9
1981	366	129	50	23	41	6	9
1982	362	113	41	21	38	5	8
1983	306	124	42	30	36	7	9
1984	348	96	29	23	30	5	9
1985	342	79	28	14	26	2	9
1986 3/	325	94	35	18	26	6	9
	Percent exported 4/	Percent of total acreage equivalents					
1970	25	100	35	22	32	6	5
1975	30	100	39	25	26	4	6
1980	39	100	36	25	27	5	7
1981	35	100	39	18	32	4	7
1982	31	100	36	19	34	4	7
1983	41	100	34	24	29	6	7
1984	28	100	30	24	31	5	10
1985	23	100	35	18	33	3	11
1986	29	100	37	19	28	6	10

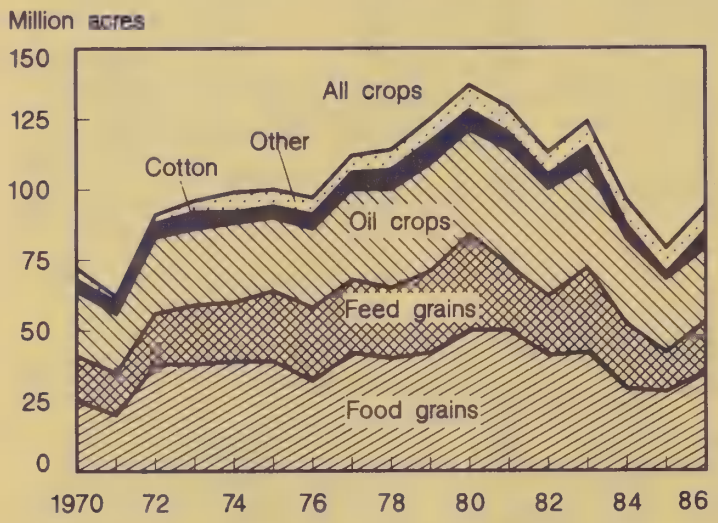
1/ For years beginning October 1. 2/ Includes all cropland harvested plus acres double cropped during calendar year. 3/ Preliminary. 4/ Acreage equivalents of exports as a percent of all crops harvested.

Source: (3,4).

acres harvested in calendar 1986 (table 10). This is up from last year's 23 percent.

Food grains represent 37 percent of total acreage equivalents in fiscal 1987, feed grains 19 percent, and oil crops 28 percent. The mix of exports has varied annually but without trend since the 1970's (fig. 3). Other crops, including tobacco, have had larger shares in recent years.

Figure 3
Acreage Equivalents of U.S. Crops Exported



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SOIL CONSERVATION

USDA Programs Achieve Record Drop in Erosion on Treated Lands

Conservation measures installed in 1987 under USDA programs could reduce average annual erosion by over 460 million tons on treated lands. This represents the largest 1-year reduction ever achieved under USDA conservation programs. The CRP, while converting nearly 14 million additional cropland acres to permanent vegetative cover in 1987, is also estimated to reduce soil erosion by over 300 million tons. Erosion treatment practices installed in 1987 under the older Conservation Technical Assistance (CTA) and Agricultural Conservation Program (ACP) are estimated to reduce cropland erosion an additional 160 million tons. The 1987 National Resources Inventory now underway will estimate erosion changes since 1982 on all agricultural lands. These estimates will include the net effects from changes in land use or cropping patterns, removal and installation of conservation practices, changes in tillage systems and other land treatments.

Erosion Down on Highly Erodible Cropland

The large reduction in average erosion on lands treated by USDA programs in 1987 results primarily from the new CRP being targeted to highly erodible cropland. Such cropland, about 5 percent of total U.S. land area, accounted for about one-fourth of the average erosion caused by water and wind in the United States. The conservation compliance and sodbuster provisions, established along with the CRP in the Food Security Act of 1985, are also directed towards highly erodible cropland. As the CRP expands and the other new programs target these highly erodible lands, additional reductions in erosion will accumulate.

Erosion Damage Likely Down Also

Targeted conservation programs will reduce the economic damages caused by eroded soil. Erosion by water and wind on agricultural lands has been estimated to cause between $6 billion and $13 billion in damages annually. Predominant were offsite damages to such activities as recreation, water treatment, water storage, and irrigation,

which accounted for $2 to $8 billion. Offsite wind erosion or dust-caused damages were estimated between $2 and $4 billion annually. Revised estimates of damage to soil productivity from lower future yields and higher fertilizer applications total over $1 billion annually. (For more discussion of the damages and implications, see the special articles by Ribaudo and by Strohbehn and Alt later in this report or the following references: 6, 16, 17, 18, 19).

CRP Sign-up Reaches 23 Million Acres

Nearly 16 million cumulative acres on 147,000 farms were under permanent vegetative cover in the CRP for fiscal 1987 (table 11). Through July 1987, another 7 million acres on nearly 55,000 farms had been signed up to start the program in fiscal 1988. If all the latest sign-ups are accepted, total enrollment in the program would be 23 million acres on about 200,000 farms. Such enrollment would be over half the 1990 goal of at least 40 million acres.

Five sign-up periods have occurred since the beginning of the program. Except for the fifth sign-up, each sign-up period had more contracts signed and more acreage enrolled than the previous one. During the March, May, and August 1986 sign-ups, farmers were permitted to enroll for either the 1986 or 1987 fiscal years. During the February and July 1987 sign-ups, farmers could enroll for the 1987 and 1988 fiscal years. The next CRP sign-up will be in February 1988.

More Acres Become Eligible

The increasing enrollment in each of the first four sign-up periods reflects both greater program awareness and interest by farmers, and changes in the definition of eligible lands. The definitional changes have increased eligible acres from almost 70 million in 1986 to over 100 million in 1987 (for details, see footnotes to table 11). A special bonus payment for corn acreage enrolled in the fourth sign-up period also provided an incentive.

Participants Receive Rental Payments and Cost Sharing

Participating farmers receive annual rental payments from the USDA for 10 years on enrolled lands and half the cost of establishing a permanent conservation cover. The annual rental payments are compensation for retiring the lands from crop production, and may be made in cash or with commodity certificates. The total rental payment to any participant may not exceed $50,000 per year, and will not affect the total amount of payments that are available under other USDA programs. The retired land cannot be used for

Table 11.--Sign-up for the Conservation Reserve Program

Item	Number of contracts	Number of acres	Cumulative acres	Average rental rate
	000	Million	Million	$/acre/yr.
Sign-up period				
#1 March 1986 1/	9.4	0.75	0.75	42.06
#2 May 1986 1/	21.5	2.77	3.53	44.05
#3 August 1986 2/	34.0	4.70	8.23	46.96
#4 February 1987 3/	88.0	9.48	17.71	51.19
#5 July 1987 tentative 3/ 4/	49.1	5.29	23.00	48.08
Program starting time				
1986	21.0	2.04	2.04	43.11
1987 tentative 4/	126.4	13.81	15.85	50.01
1988 tentative 4/	54.7	7.15	23.00	46.96

1/ Eligible acres included cropland in land capability classes II through V eroding at least three times greater than the tolerable rate (see definitions), or any cropland in land capability classes VI through VIII. 2/ Eligible acres expanded to include cropland in land capability classes II through V eroding at least two times the tolerable rate and having gully erosion. 3/ Eligible acres further expanded to include cropland eroding above the tolerance rate with an erodibility index of eight or greater. 4/ Number of accepted bids. Actual number of contracts and acres enrolled may be less.

Source: (11)

pasture, hay, or other agricultural production activity during the contract period (in some special cases of drought or emergency, a temporary waiver may be given).

To participate in the CRP, farmers submit an offer to participate at their local Agricultural Stabilization and Conservation Service (ASCS) office during an announced sign-up period. The offer may be made only for fields containing at least two-thirds highly erodible cropland. USDA acceptance of any offer depends upon: 1) the field meeting the definition of highly erodible cropland, 2) the offer being not greater than the established maximum per acre annual rental payment for the area, and 3) the total county enrollment not exceeding 25 percent of county cropland acreage (unless a special waiver has been granted to the county).

Rental payments to farmers averaged about $43 per acre for acreage enrolled for the 1986 crop year and about $50 for acreage enrolled for the 1987 crop year (table 11). Average rental payment rates have increased each enrollment period except in the fifth, as the locational distribution of acreage enrolled has changed and as farmers have become aware of the maximum acceptable rental rates for their area. In the first three sign-up periods over 8 million acres were enrolled. The majority of these acres came from the Mountain and Southern Plains regions with average yields on enrolled acreage considerably lower than the national average. The fourth sign-up added over 9 million acres, nearly 50 percent of which came from the Northern Plains, Corn Belt, and Lake States regions. Yields on this additional acreage were about 10 percent higher than on the acreage enrolled in previous sign-ups. The one-time bonus payment of $2-per-bushel of average yield for corn acreage enrolled in the fourth sign-up may have helped influence this regional shift.

About 85 percent of the acreage enrolled in the CRP used grass as a permanent cover, for an estimated average 10-year cost of about $80 per acre, half of which was cost-shared. Tree planting took place on less than 6 percent of the acreage enrolled with an estimated average cost of about $76 per acre. The remaining acreage was either previously in grass or trees, placed into wildlife habitat or grass waterways, used for windbreaks, or covered with erosion control structures or treated with some other conservation practice.

Economic Impacts Likely in High Enrollment Areas

Areas with high enrollment and large reductions in erosion may benefit economically from enhanced recreation and other water uses resulting from improved water quality. Farmers' incomes will be supported by USDA rental payments for the retired land. However, taking the land out of production may reduce farmers' production expenditures and affect some local communities and agribusiness.

Establishment of permanent vegetative cover will initially increase demand for grass seed and tree seedlings. Thereafter, farmers may purchase less of specialized equipment and other production inputs that are no longer needed, but could change purchases of other items for land still in production. Where grain production is the predominant enterprise, economic activity is determined more on volume of grain marketed than on income levels of producers. Economic activity in rural communities could be reduced in proportion to the reduction in harvested acreage.

The Northern and Southern Plains, Mountain, and Corn Belt regions have enrolled the largest acreages in the program (table 12). More than 11 percent of the total cropland in the Mountain region is enrolled, and 8 percent in the Southern Plains. The Mountain, Southern Plains, and Appalachian regions have potential acreage eligible exceeding one-fourth of their total cropland. However, no county can enroll more than one-fourth of its cropland except by special USDA waiver. Through July 1987, this waiver had been granted to 59 counties.

CRP acreage relative to harvested cropland--which excludes fallow, idled cropland, cropland pasture, and land with crop failure--may be the best indicator of where the program will most affect rural communities and agribusiness. Through July 1987, 170 counties had enrolled more than one-forth of their harvested cropland, with the majority in the Mountain and Southern Plains regions.

Table 12.--Regional distribution of current and potential CRP

Region	CRP thru July 1987			Potential CRP		
	Acres enrolled	Share of U.S. acres enrolled	Percent of region's cropland	Eligble acres	Share of U.S. total	Percent of region's cropland
	Million	Percent		Million	Percent	
Northeast	0.11	0.5	0.6	4.2	4.1	24.3
Lake States	1.98	8.6	4.5	6.1	6.0	13.9
Corn Belt	3.27	14.2	3.5	21.8	21.5	23.6
Northern Plains	5.23	22.7	5.6	16.9	16.7	18.1
Appalachia	0.76	3.3	3.3	6.7	6.6	29.5
Southeast	0.99	4.3	5.3	3.3	3.2	17.7
Delta States	0.68	3.0	3.1	2.5	2.5	11.4
Southern Plains	3.65	15.9	8.1	16.9	16.7	37.6
Mountain	4.86	21.1	11.2	18.5	18.2	42.7
Pacific	1.47	6.4	6.4	4.6	4.5	20.0
United States	23.00	100.0	5.5	101.5	100.0	24.1

Source: (10,11)

Barley, Sorghum, and Oat Acreages Most Affected

Although the principal purpose of the CRP is soil conservation, the retired cropland also reduces the base acreage of USDA commodity programs, and may reduce USDA payments to farmers under these programs. While more base acres of wheat have gone into the CRP than any other crop, the largest proportional reductions, and hence greater effects, have been with barley, sorghum, and oats. Over 14 percent of 1985 barley base, and about 9 percent of the sorghum and oat base acreages have been retired (table 13).

The earlier sign-ups attracted relatively more acreages of low valued crops of barley, oats, and sorghum, while the later sign-ups were proportionately greater in the higher valued crops of corn and cotton. Further, crop yields on the base acreages retired from production averaged higher each sign-up period. This indicates that more productive land is increasingly being put into the program. As this continues to occur and a larger proportion of higher value crop base is retired, the prices of surplus commodities could strengthen, thus reducing total deficiency payments.

Table 13.--Commodity base acreages enrolled in the CRP through July, 1987 (Preliminary).

Crop	Total base acreage in 1985	Base acreage enrolled in CRP	Share enrolled in CRP
	Million acres		Percent
Barley	12.4	1.8	14.5
Sorghum	18.9	1.7	9.0
Oats	9.2	0.8	8.7
Wheat	91.7	6.8	7.4
Cotton	15.4	0.9	5.8
Corn	82.2	2.7	3.3
Rice	4.1	2/ ---	---
Peanuts	1/ 1.5	---	---
Tobacco	1/ 0.7	---	---
Total	236.1	14.7	6.2

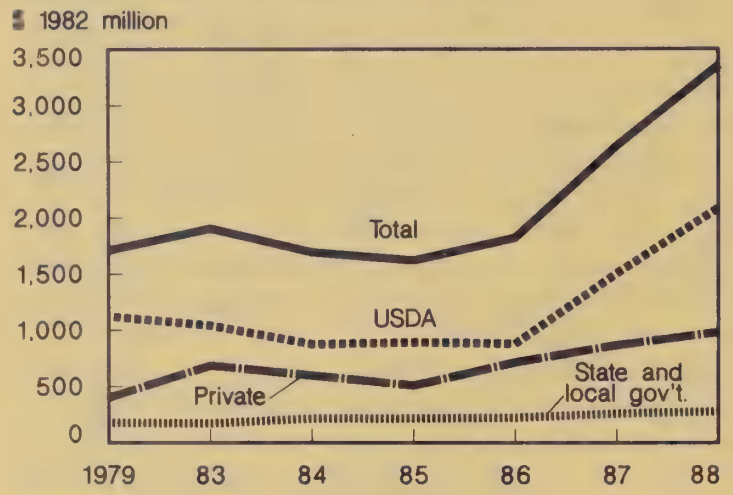
1/ Acres harvested. 2/ Negligible.

Source: (10,11)

Conservation Expenditures Increase

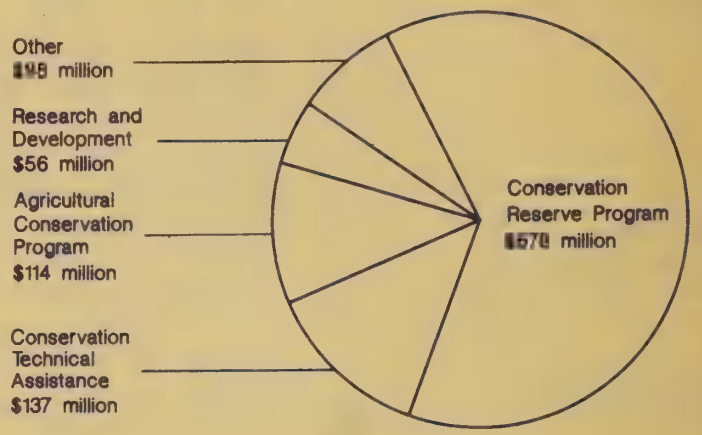
Total public and private expenditures in 1987 on land and water conservation are estimated at nearly $2.6 billion (1982 dollars, figure 4). The expenditures are up 44 percent from 1986 and up 53 percent from 1979. Large increases in CRP expenditures in 1988

Figure 4
U.S. Land and Water Conservation Expenditures



Source: (15,23)

Figure 5
USDA Soil Conservation Programs and Expenditures, 1987



Total expenditures: $1,073 million (1982 dollars).
Source: (15)

could expand total public and private conservation expenditures to nearly $3.4 billion.

Total USDA expenditures on land and water conservation in 1987 of about $1.5 billion are 71 percent above 1986, because of a large increase in expenditures on erosion control (table 14). Erosion control's proportion is about $1.1 billion or nearly 71 percent, up from 43 percent in 1986. Most of the increase in erosion control expenditures results from the Government sharing 50 percent of the cost of establishing permanent cover on lands enrolled in the CRP. Part of the increase comes from annual rental payments on CRP lands and the additional technical assistance devoted to servicing the CRP program. The combined expenditures on CRP make this activity USDA's largest soil conservation program (figure 5).

Federal rental payments to farmers for retiring lands from production under the CRP are estimated at nearly $74 million for 1987, but could increase to over $700 million in 1988 (table 14). An undetermined part of these rental payments will be offset by commodity program savings.

State and local government appropriations for conservation increased an average of 4.8 percent per year between 1979 and 1987 (figure 4). Increases since 1986 have been sharper than the long-term trend. States with the largest increases since 1985 are Minnesota, Nebraska, Missouri, North Carolina, Wisconsin, and New York. States with large decreases are Texas, Oklahoma, Ohio, California, Iowa, and Illinois.

Private expenditures on conservation, estimated at $871 million in 1987, have been rising since 1985 as farmers have paid their share of the costs to establish permanent vegetative cover on CRP acreage and of other conservation treatments.

Conservation Compliance Begins in 1990

The conservation compliance provision of the Food Security Act of 1985 requires that implementation of approved conservation plans for highly erodible lands currently in crop production must begin by January 1, 1990, and be completed by January 1, 1995. An exception is made for land not yet mapped by the Soil Conservation Service (SCS). If such implementation does not occur, the farmers involved will lose eligibility for Government commodity price and income support programs, crop insurance, disaster payments, Farmers Home Administration loans, Commodity Credit Corporation storage loans, farm storage facility loans, CRP payments and all other USDA commodity related program payments. The approving agency for the conservation plans is the local conservation district.

Some 60 Million Acres Still Need Treatment

Some 118 million cropland acres are considered highly erodible under the conservation compliance provision. However,

Table 14—USDA land and water conservation and erosion control expenditures from appropriations, fiscal years 1979, and 1986–88 1/

Activities and programs 2/	All conservation expenditures				Soil erosion control			
	1979 actual	1986 actual	1987 estimated	1988 estimated	1979 actual	1986 actual	1987 estimated	1988 estimated
	Million 1982 dollars 3/							
A. Onfarm technical assistance and extension	246.6	261.1	292.0	286.3	121.3	134.2	163.1	177.3
Conservation technical assistance (SCS)	225.3	229.8	249.2	259.2	114.9	119.5	137.0	155.5
Extension information and education (ES)	14.5	13.8	13.6	10.6	6.2	5.6	6.1	5.3
Cooperative forestry management (FS)	6.8	8.4	9.2	0	0.2	0.1	0	0
Technical/assistance—CRP (SCS/ASCS) 4/	0	9.1	20.0	16.5	0	9.1	20.0	16.5
B. Onfarm installation cost-sharing	354.4	176.7	769.2	803.1	161.7	125.9	716.3	796.4
Agricultural Conservation Program (ASCS)	298.2	127.7	150.4	0	128.3	97.1	114.3	0
Forest Incentives Program (ASCS)	18.4	10.3	12.2	0	18.4	10.3	12.2	0
Water Bank Program (ASCS)	10.5	8.5	7.5	0	0	0	0	0
Great Plains Conservation Program (SCS)	27.3	18.8	14.9	10.8	15.0	7.1	5.6	4.1
Cover establishment—CRP (ASCS/CCC) 4/	0	11.4	584.2	792.3	0	11.4	584.2	792.3
C. Project conservation programs	339.0	268.8	198.6	115.5	10.1	30.5	23.1	13.5
Watershed and flood prevention (SCS)	306.4	243.9	175.9	101.7	6.2	24.3	17.5	10.1
Resource conservation & development (SCS)	32.6	24.9	22.7	13.8	3.9	6.2	5.6	3.4
D. Subtotal for implementation (A + B + C)	940.0	706.6	1,259.8	1,204.9	293.1	290.6	902.5	987.2
E. Conservation research and development (FS, ARS, CSRS, ERS)	93.2	99.5	101.5	94.9	21.6	51.7	55.8	56.9
F. Data collection and analysis (SCS)	95.1	75.1	74.5	73.1	38.9	38.3	41.0	43.8
G. Rental payments—CRP (ASCS/CCC) 5/	0	0	73.6	719.4	0	0	73.6	719.4
H. Total distributed expenditures (D + E + F + G) 6/	1,128.3	881.2	1,509.4	2,092.3	353.6	380.6	1,072.9	1,807.3
—Relative to 1986 expenditures (%)	128	100	171	237	92	100	282	475
—Share for erosion control (%)	31	43	71	86	--	--	--	--

1/ Current dollar estimates from Budget of the U.S. Government for Fiscal Year 1988 (Appendix), supplemented with data from the 1980 RCA report, later RCA data from USDA, and unofficial ASCS estimates for 1986–88 for the Conservation Reserve Program (15). Erosion control expenditures are not in the official budget but are estimated from erosion control percentages given for individual USDA programs in RCA and other reports (12). Most such percentages by programs are assumed to remain substantially unchanged between 1985 and 1988. 2/ Responsible USDA agencies in parentheses: CCC—Commodity Credit Corporation; SCS—Soil Conservation Service; ES—Extension Service; FS—Forest Service; ASCS—Agricultural Stabilization and Conservation Service; ARS—Agricultural Research Service; CSRS—Cooperative State Research Service; and ERS—Economic Research Service. 3/ Current-dollar estimates converted to 1982 dollars using implicit price deflators for nondefense Federal government personnel compensation for categories A, E, and F. Implicit price deflators or fixed-weight price indexes for Federal purchases of conservation and development structures used for categories B and C. Deflators generally from the Survey of Current Business, Vol. 67, No. 3 (March 1987), Vol. 61, No. 7 (July 1981), and intervening July issues of the Survey. 4/ Technical assistance and cover establishment components of the Conservation Reserve Program (CRP) are assumed to be all erosion control, as highly erodible lands are the principal focus of the program. For FY 1986 and FY 1987, funds and facilities of the Commodity Credit Corporation (CCC) were authorized to implement the CRP, as administered by ASCS. For FY 1988, funds and facilities of CCC may continue to be used, but a separate appropriation is proposed to ASCS for advance to CCC to implement the program. 5/ Included as conservation, since principal purpose of CRP is conservation. However, an undetermined part of this will be offset by commodity program savings. Excludes corn bonus payment. 6/ Includes those programmed and nonrepayable expenditures that can be allocated among soil erosion control, water conservation, urban, wildlife, and other resource concerns. Not included are all loan programs of FMHA and emergency conservation programs of ASCS.

Table 15.--Cropland affected by conservation compliance

Region	Cropland requiring compliance by 1990				
	Total before CRP 1/	Maximum enrolled in CRP through July '87 2/	Balance requiring compliance by 1990 or enrollment in CRP		
			Minimum area 3/	Share of U.S. total	Share of region's cropland
	Million acres			Percent	
Northeast	3.7	0.1	3.6	6.0	21
Lake States	3.9	2.0	1.9	3.2	4
Corn Belt	19.1	3.2	15.9	26.3	17
Northern Plains	13.8	5.2	8.6	14.2	9
Appalachia	5.9	0.8	5.1	8.4	22
Southeast	2.7	1.0	1.7	2.8	9
Delta States	2.3	0.7	1.6	2.7	7
Southern Plains	13.8	3.6	10.2	16.9	23
Mountain	14.7	4.9	9.8	16.2	23
Pacific	3.5	1.5	2.0	3.3	9
United States	83.4	23.0	60.4	100.0	14

1/ Includes all lands with an erodibility index (EI) equal to or greater than 8, excluding 35 million acres of such cropland eroding at T level or less under current use and management and thus considered as already being under compliance. 2/ Maximum acreage, based on assumption that all CRP lands through the July 1987 sign-up had an EI equal to or greater than 8. 3/ Could be slightly greater to the extent some of CRP acreage included lands with EI less than 8.

Source: (2,4,9,10)

35 million of these acres are considered in compliance under current management (currently eroding at less than the tolerance level), and up to 23 million acres have been placed in the CRP. This leaves at least 60 million acres or about 14 percent of U.S. cropland, which will require either placement into the CRP, if that option exists, or implementation of a conservation plan before 1995. Most highly erodible lands going into the CRP, however, will require conservation plans if and when they are returned to crop production after CRP contracts expire.

Farmers with highly erodible cropland must implement conservation plans in accordance with the SCS technical guide. In general, conservation plans are developed to reduce erosion to or below the soil loss tolerance level. In cases where compliance with the SCS technical guide will cause a financial hardship on farmers, an exception may be made to use less restrictive conservation practices.

Some Regions More Significantly Affected

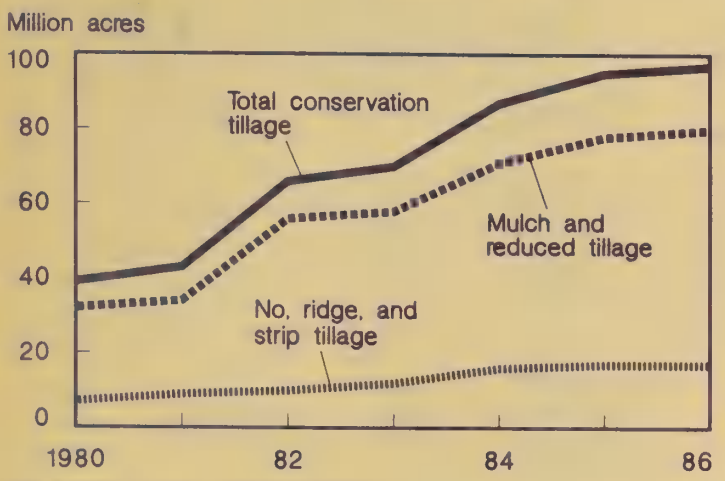
The majority of the 60 million acres still requiring treatment under conservation compliance is located in four regions: the Corn Belt (26 percent), the Southern Plains, the Mountain Region, and the Northern Plains (14–17 percent each) (table 15). However, several other regions will have an equal or greater proportion of their cropland requiring treatment. One-fifth or more of the cropland in the Appalachian and Northwest regions will need CRP or other treatment to meet compliance requirements.

Cost of Achieving Compliance

The cost of achieving compliance will depend upon the acres still requiring treatment that have not gone into the CRP, and the extent to which exceptions are given to the erosion reduction criterion of T or below. A preliminary analysis of the 83 million cropland acres of highly erodible lands eroding above the T level, as reported in the 1982 National Resources Inventory, indicates that to meet the one T criterion over two-fifths would need only conservation tillage (mostly no-till), over one-third would need structural practices perhaps in combination with conservation tillage, and one-fifth would require a permanent cover. Exceptions to the one T criterion would reduce

Figure 8

National Use of Conservation Tillage



Data adjusted to reflect changes in definition.
Source: (8, 20)

Table 16.—Crops under conservation tillage (CT), 1986

Crop	U.S. acres in CT	CT as a share of total acres in crop
		percent
Corn (full season)	32.4	41
Soybeans (full season)	20.5	34
Small grain (fall seeded)	19.4	34
Small grain (spring seeded)	14.5	32
Sorghum (full season)	5.7	32
Soybeans (double crop)	3.1	51
Forage crops	1.4	23
Sorghum (double crop)	0.7	35
Corn (double crop)	0.4	31
Cotton	0.3	3
Other crops	1.6	9
Total	100.0	

Source: Conservation Tillage Information Center (8)

the need for structural measures or permanent cover and lower the cost of achieving compliance. However, fewer tons of erosion would be prevented, with correspondingly lower productivity and less offsite benefits.

Sodbuster Provision Now in Effect

The sodbuster provision of the Food Security Act of 1985 became effective December 12, 1985, but a 1-year grace period was given farmers converting land to allow them to implement necessary conservation measures. The provision requires farmers converting highly erodible range and forest lands into cultivated cropland to have an approved conservation plan, or lose eligibility for Government program benefits (same benefit loss as for farmers not meeting the compliance provision). The sodbuster provision also will apply to most lands going into the CRP if they are again converted from permanent cover to cropped land.

Conservation Tillage Use Expands

Nationally, data gathered by the Conservation Tillage Information Center (CTIC) show conservation tillage used on more than 97 million acres in 1986 (figure 6). Conservation tilled land nearly reached 30 percent of all land in crops, up from 28 percent in 1985 and 25 percent in 1984. In 1980, conservation tilled land was likely under 40 million acres and 11 percent of total land in crops.

Most of the increase in conservation tillage has been mulch or reduced till, which can reduce erosion by around 50 percent compared with conventional clean tillage. However, use of ridge, strip, and no-till, which can reduce erosion by 75 percent or more, has more than doubled since 1980.

Corn and small grains each accounted for about one-third of the conservation tilled acreage in 1986 (table 16). Soybeans had over one-fifth of the acres in the practice. All other crops, principally sorghum, made up only about one-tenth of the acres.

Relative use of conservation tillage was greatest on double cropped soybeans (51 percent of acres in that crop), full season corn (41 percent), double cropped sorghum, fall seeded small grain, and full season soybeans (each with a 34–35 percent use rate).

In 1986 the Corn Belt had both the highest relative use of conservation tillage (43 percent of planted acres) and, because of large amounts of cropland, also the highest acreage in the practice, over one-third of the U.S. total (table 17). The Northern Plains had slightly lower relative use than the Appalachian and Northeast regions, but much higher acreage in the practice, nearly one-fourth of the U.S. total.

Regions with lowest use of conservation tillage are in the southern and far western United States. Even so, use of the practice in

Table 17.--Regional distribution and importance of conservation tillage (CT), 1986

Region	Acres in CT	U.S. acres in CT	CT's share of total acres in region
	Millions		Percent
Corn Belt	33.7	34.6	43
Northern Plains	23.6	24.2	36
Lake States	8.4	8.6	27
Mountain	8.2	8.4	36
Southern Plains	6.6	6.7	20
Appalachia	6.0	6.1	40
Northeast	3.5	3.5	40
Delta States	2.6	2.8	15
Pacific	2.6	2.7	19
Southeast	2.3	2.4	21
United States	97.5	100.0	

Source: Conservation Tillage Information Center (8)

the Southeast has nearly doubled and in the Delta States nearly tripled since 1983.

Conservation Tillage Also Reduces Implement Use and Cost

Farmers practicing conservation tillage make fewer trips over the field than those using conventional methods. Nearly two-thirds of the corn acres in strip, ridge, and no-till in 1985 had no tillage operations of any type performed prior to seeding. Corn farmers practicing reduced or mulch tillage averaged 3.2 times over the field, compared to over 3.8 times for those with land in conventional tillage, and relied on the chisel plow or some type of disk as the major soil working implement. Fewer times over the field save on equipment, fuel, and labor.

Many farmers changing to conservation tillage, particularly no-till, initially apply additional pesticides to control weeds and insects. Also, if they have to purchase or rent new equipment, particularly no-till or heavier planters, before old equipment is worn out, short-run equipment costs may be higher. How much overall cost savings, if any, a farmer realizes in the short run with conservation tillage thus depends on how savings on some items offset higher costs on others. Generally in the long run, as equipment must be replaced anyway and fewer trips are made across the field, overall cost savings occur with conservation tillage.

Expansion Prospects Are Mixed

Retirement of cropland from production under the CRP may reduce the expansion rate of conservation tillage. If 30 percent of the nearly 14 million acres placed in the CRP in fiscal 1987 had conservation tillage in 1986, the retirement of this land from production would reduce conservation tillage by about 4 million acres, offsetting increases on non-CRP lands. Also lowering the expansion in early 1987 have been the credit constraints and farm incomes of past years, which curtailed farmers' purchases of new equipment needed for some types of conservation tillage.

Conservation tillage is generally expected to increase over the long term. Conservation tillage will likely be cost-effective for farmers to implement on lands needing to be brought into compliance. This requirement could stimulate adoption of conservation tillage depending upon the extent to which farmers choose to comply rather than lose USDA program privileges. Also with improved incomes, farmers may begin purchasing new equipment and may decide to change to conservation tillage farming. A factor causing potential declines in some areas may be the concern about the practice's impact on groundwater quality. Also detracting from expansion will be the loss of some conservation tilled acres going into the CRP.

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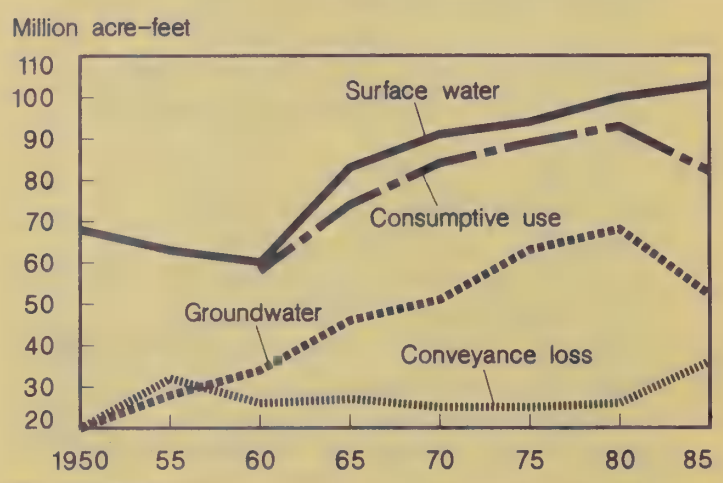
WATER

Irrigation Water Use Declines

Irrigation water withdrawals in 1985 declined for the first time since 1950. Preliminary 1985 data indicate a 9-percent decrease from 1980 along with a reduction of irrigated acres (figure 7). This unprecedented decline mirrors a 25-percent drop in groundwater use from 1980 to 1985. Surface water use continued its long term expansion, supported by above average reservoir and snow conditions. During the past 35 years, the use of groundwater for irrigation increased 160 percent while surface water sources increased about 50 percent.

During 1985 reservoirs were generally full at the beginning of the irrigation season and the snow pack was average or better than normal. These above normal water supplies likely affected the quantity of water used. Irrigators, who were able, partially substituted the cheaper and larger-than-normal supplies of surface water for groundwater. In areas of groundwater decline, where surface water sources were limited, irrigators reduced application rates or temporarily shifted to dryland production in response to generally low commodity prices and increased pumping costs.

Figure 7
U.S. Irrigation Water Withdrawals



1985 data preliminary.
Source: (9, 10)

Groundwater use in the Plains States this year is expected to be down in response to above-average rainfall. Snowfall this past winter was light in the western mountains, which may reduce reservoir levels and the amount of surface water available for the 1988 crop year.

Declining Groundwater Levels A Regional Concern

Groundwater Drawdown Occurring in Sections of 11 States

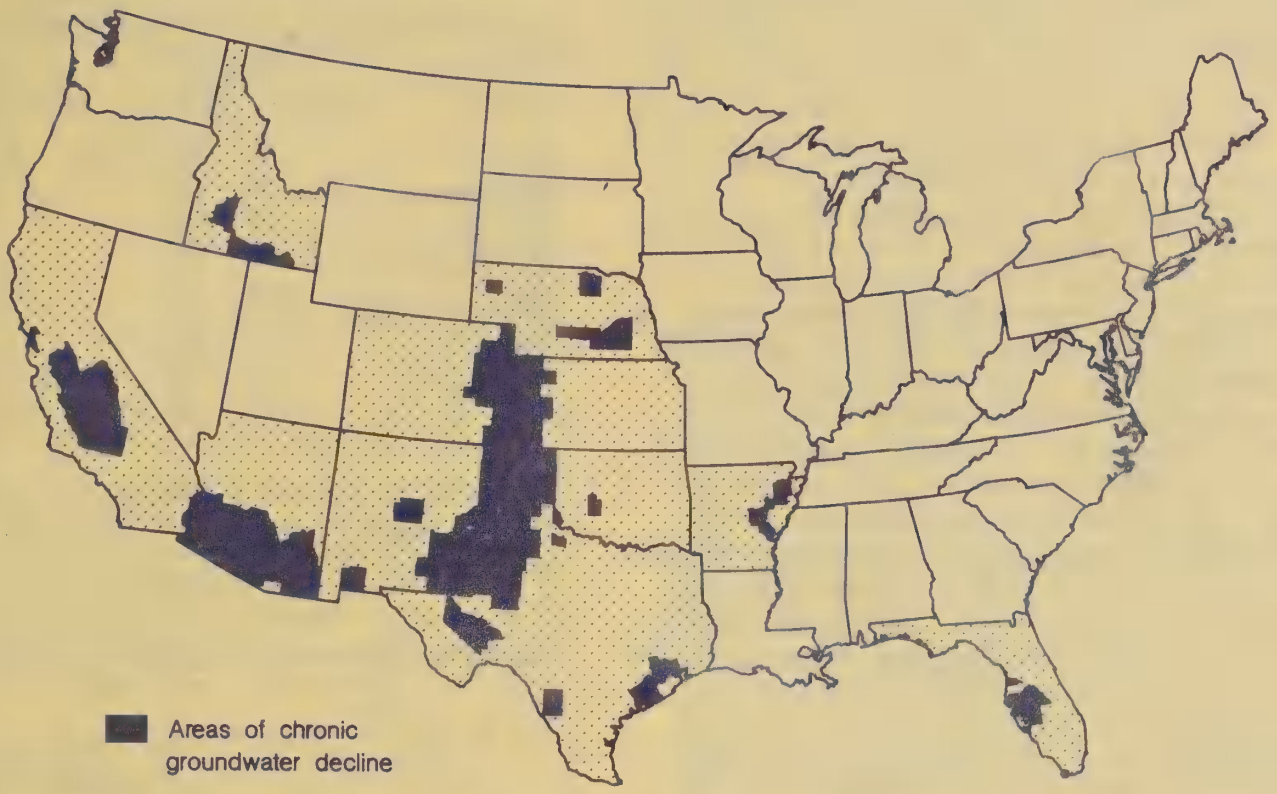
Although annual total groundwater withdrawals declined between 1980 and 1985, many regions of the country where groundwater is used heavily for irrigation still are experiencing a decline in the groundwater table (groundwater mining) (figure 8). The reliance on water from the Ogallala Aquifer in the Plains States is particularly evident. Reports from the region for 1986 document a continuing decline of the aquifer in Kansas but, for the first time in 36 years, an increase in the water table of more than one-half foot in the High Plains of Texas.

Groundwater drawdown leads to increases in the pumping lift (the distance from the groundwater table to the land surface) that is required to raise the water to the surface. Increased lifts result directly in increased groundwater pumping costs. See table 18 for average pumping lifts and average rates of decline in water tables for major groundwater irrigated states. Economic exhaustion of an aquifer (that is, when pumping no longer is financially viable) is the ultimate consequence of continued mining.

Irrigated Agriculture Adapts to Declining Groundwater Levels

Farmers adapt in several ways to a decline in the groundwater table. Ultimately they must return to dryland farming or abandon farming in the affected areas. Acreage already is being converted from irrigated to dryland farming in the High Plains region of Texas. As the expense of pumping

Figure 8
Major Areas of Groundwater Mining



* Determinations were made by U.S. Geological Survey. Each of these 11 states has more than 500,000 acres in groundwater irrigation. Taken together, they account for 85 percent of the total U.S. area irrigated with groundwater.

increases, farmers can make several intermediate changes in their practices before the farm operation must revert to dryland farming.

Farmers can switch to crops that either require less water or have higher economic returns to water; in the Texas High Plains, this implies a switch to irrigated cotton production. Producers can also install conservation devices or irrigation technology that uses water more efficiently; in the Texas High Plains, again, use of drop- line center pivot sprinkler systems and furrow dikes is increasing. Improved irrigation scheduling, which also improves water use efficiency, can be adopted. These adaptations demonstrate the natural resiliency of irrigated agriculture when faced with the expenses associated with groundwater decline.

Some localities, nevertheless, will experience a decline in agricultural output as farm operators either revert to dryland production techniques or leave agriculture. From a public perspective, this raises the issue of what assistance is needed by producers and rural communities as this transition is made.

Some States Respond to Groundwater Drawdown with New Management Plans

Texas is notable for addressing the issue of declining groundwater tables with educational efforts directed at voluntary, on-farm water conservation. Other states have responded with a regulatory approach to reducing the pace of groundwater drawdown. New Mexico empowers the Office of the State Engineer to decide the pace of groundwater mining in heavily- used basins. Kansas empowers local groundwater districts to set mining rates and to limit new well development as one means of achieving the rate. Arizona, which gained much attention for adopting the Arizona Groundwater Management Act of 1980, empowers regional agencies within groundwater Active Management Areas. In the Pinal Active Management Area, where groundwater is used almost exclusively for irrigation, the water conservation program establishes an irrigation water duty and a maximum annual groundwater allotment for each farm. The Arizona act intends to make irrigation water duties more stringent through time. The intent of the irrigation water duty is to impose

additional costs in the form of water conservation requirements on individual farm operations as a tradeoff for reduced future pumping costs associated with slower mining rates.

Individual States, historically, have exercised exclusive responsibility for administration and management of groundwater pumping. Yet, some members of the U.S. Congress favor development of Federal policy concerning groundwater use. A bill recently introduced in the U.S. House of Representatives--the Reclamation States Groundwater Protection Act of 1987--proposes such a policy. The bill would encourage the 17 western States to manage more closely their groundwater, especially with regard to groundwater drawdown. Under the proposed legislation, western states with critical groundwater problems that do not adopt a groundwater management plan will not receive Federal funds for water project construction. Further, the Secretary of the Interior would be prohibited from executing any existing U.S. Bureau of Reclamation water delivery contracts with those States. The proposed bill highlights Arizona's Groundwater Management Act of 1980 as a model code for other States to consider.

Agriculture Is a Major Water User

Agriculture accounts for 36 percent of all surface and ground water withdrawals in the United States. In 1985 about 402 billion gallons per day (bgd) were withdrawn for the four principal offstream uses: industrial, agricultural, domestic, and commercial (figure 9). About 60 bgd or 15 percent of all withdrawals were saline water used mainly for industrial cooling. Total withdrawals were about 11 percent less than in 1980. Industrial diversions accounted for more than half of all withdrawals and 85 percent of these went for thermo-electric power generation. Irrigation is the second largest water user, accounting for 34 percent of withdrawals. Public water supplies took about 9 percent, while rural domestic and livestock uses combined accounted for no more than 2 percent.

Of the fresh water withdrawals for agricultural purposes in 1985, over 94 percent were used for irrigation, slightly more than 2

Table 18.--Lift and rate of decline for areas of groundwater decline in major groundwater irrigated States, 1985.

State	Average pumping lift	Average annual rate of decline in water table
	------Feet 1/ -------	
Arizona	75 - 535	2.0 - 3.0
Arkansas	50 - 120	.5 - 1.3
California	100 - 260	.5 - 3.5
Colorado	175 - 275	2.0
Florida	250	2.5
Idaho	200 - 375	1.1 - 5.0
Kansas	190 - 275	1.0 - 4.0
Nebraska	25 - 250	.5 - 2.0
New Mexico	100 - 200	1.0 - 2.5
Oklahoma	100 - 275	1.0 - 2.5
Texas	50 - 300	1.0 - 4.0

1/ The amount of lift and the annual rate of decline are the ranges of averages in the States.

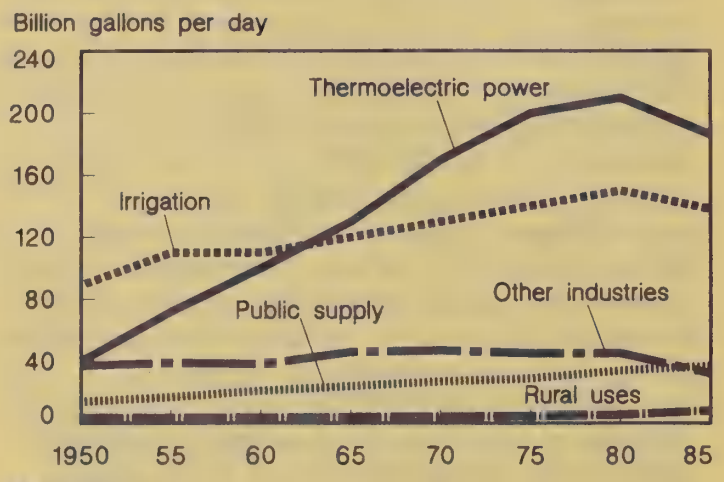
Source: (8).

Table 19.--Quantities of ground and surface water withdrawn by major users, United States, 1985

	Water source		
	Ground	Surface	Total
	Billion Gallons per day		
Public water supplies	15	22	37
Self supplied industrial			
Thermo electric power	1	186	187
Other industrial uses	7	25	32
Agricultural:			
Irrigation	46	92	138
Rural domestic & livestock	6	2	8
Total	75	327	402

Source: (10).

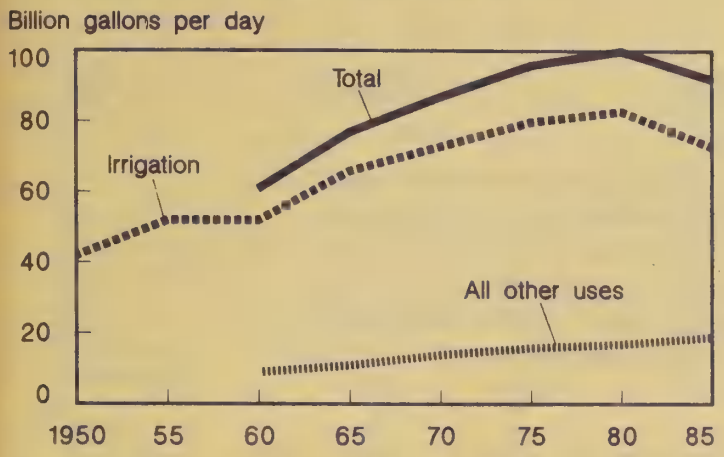
Figure 9
U.S. Water Withdrawals by Major Uses



BLS preliminary.
Source: (9, 10)

Figure 10

Estimated Consumptive Water Use



1985 data preliminary. Estimates are not available for all other water uses from 1950 to 1955.
Source: (9, 10)

percent went for domestic use, and about 3.5 percent was used for livestock. About three-fifths of this water came from surface sources and the remainder from groundwater (table 19).

Water used for rural domestic purposes in 1985 was 3.3 bgd while livestock including aquaculture needs equaled 5 bgd. Groundwater provided for more than 97 percent of domestic and 58 percent of livestock needs. In contrast to the other principal uses of water, which are relatively steady throughout the year, irrigation needs are highly seasonal and can be very competitive with other uses, particularly in the Lower Colorado and Rio Grande River Basins. On an annual basis irrigation diversions averaged 138 bgd in 1985. But because the water is only required during the growing season, the diversion rates often exceed 500 bgd, which places a significant short-term drain on the resource.

Of the total water consumed by all uses in 1985, agriculture took 84 percent (figure 10). Over half of all water applied to crops through irrigation is consumptively used. Consumptive use makes water unavailable for further use because of evaporation, transpiration, or incorporation into products or crops. In addition, not all water withdrawn reaches the intended point of use. Water is lost in transit from the withdrawal point to the field because of leakage, spills, and evaporation from pipes, canals, conduits, and ditches. Conveyance losses of 32 million acre feet (MAF) in 1955 dropped to 25 MAF in 1970 and have remained near that level with the rising proportion of groundwater use and conservation efforts. Preliminary data for 1985 indicate an increase in conveyance loss as groundwater use declined and was partially replaced by expanded use of surface water. Conveyance losses are not permanent because most of the water eventually finds its way back into the water source and is available for other uses.

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AGRICULTURE'S IMPACT ON WATER QUALITY

by

Marc O. Ribaudo

Abstract: Agriculture generates sediment and chemical residuals which can affect the quality of surface and groundwater resources. Damages to water resources may be significant, especially at the local level. Laws have been enacted to protect surface and groundwater from nonpoint source pollution. These laws may affect agricultural production, and the potential exists for farm incomes and crop prices to change as a result of efforts to meet water quality goals.

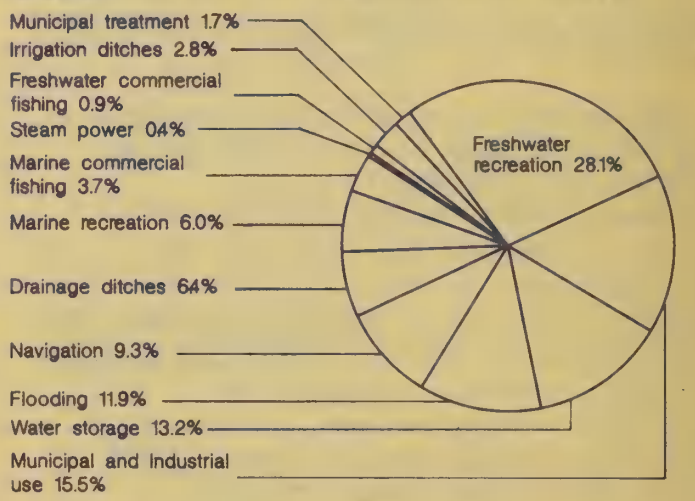
Keywords: soil erosion, nutrients, sediment, pesticides, water quality, point and nonpoint source pollution, surface and ground water.

Nature of the Problem

Agricultural runoff can affect the quality of surface and groundwater. Major residuals in the runoff include nutrients from chemical fertilizers and animal manure (primarily nitrogen and phosphorus), pesticides, and sediment.

Preparing land for crop production and the grazing of livestock may remove protective vegetation cover and disturb the soil, causing erosion. Sediment washing off the land and into waterways can fill reservoirs, block navigation channels, interfere with water conveyance systems, affect aquatic plant life, and degrade recreational resources.

Figure 1
Share of Offsite Damages from Agricultural Erosion



Source: (6)

Chemical pesticides and fertilizers are important inputs to U.S. agriculture. A portion of these chemicals may run off into surface waters or leach into aquifers. Pesticides affect aquatic plant and animal life, and sufficient quantities in drinking water supplies may endanger human health. Chemical fertilizers and animal manure may promote the premature aging of lakes and estuaries, affecting recreational opportunities, municipal and industrial water supplies, and commercial fishing. Nitrates from fertilizer in drinking water supplies can also pose a human health risk.

Surface Water Pollution

Surface water damages from soil erosion on agricultural land (cropland, pasture, and range) are estimated to range between $2 and $8 billion per year (8). Figure 1 shows how these damages are allocated among various water users. The Corn Belt and Pacific regions are impacted the most. However, much more needs to be known about the physical and chemical relationships between soil erosion on the field and residuals in surface waters to accurately determine damages.

Knowing agriculture's contribution of nitrogen, phosphorus, and sediment to surface waters is important in maintaining or improving water quality in the United States. (table 1). Nationally, agriculture is estimated to account for 52 percent of the suspended sediment and phosphorus, and 61 percent of the organic nitrogen discharged in surface

Table 1.--Percentage of surface water pollutants discharged from agricultural sources, by region, (1982) 1/

Region	Suspended sediment	Nitrogen	Phosphorus
	---------percent---------		
Northeast	33.2	25.6	27.5
Lake States	66.8	65.7	56.9
Corn Belt	75.0	80.0	78.6
Northern Plains	52.6	75.6	69.3
Appalachia	45.0	49.2	41.8
Southeast	32.4	39.0	31.3
Delta	53.7	62.3	52.4
Southern Plains	49.8	72.3	62.9
Mountain	43.8	60.5	61.4
Pacific	28.1	29.2	28.3
United States	51.9	61.2	52.5

1/ Agricultural sources include cropland, pasture-land, rangeland, and feedlots.

Source: (1,2)

waters each year from all sources (1,2). Where agriculture is very important, such as in the Corn Belt and Northern Plains, the percentages are higher. Significant improvements in water quality in these regions will not be possible unless agriculture's contribution of pollutants can be reduced.

Additional evidence that agricultural activities have impacts on water quality comes from a study by the U.S. Geological Survey (7). This study reported that during 1974-1981 most stations showed no trends in the concentrations of suspended sediment, organic nitrogen, and phosphorus. However, where increasing concentrations of these materials were observed, they tended to be statistically related to various measures of agricultural activity, such as fertilizer use, livestock density, and cropland erosion. On the other hand, decreasing concentrations of these pollutants reflected reductions in point-source loadings from sewage treatment plants and industry. The time of this study was characterized by a rapid expansion in the agricultural sector and a more intensive use of inputs. The study implies that decreases in the use of inputs and the acreage under production may reduce the concentrations of suspended sediment, nitrogen, and phosphorus.

Groundwater Pollution

Agriculture is also a potential source of groundwater pollutants, accounting for about 67 percent of all pesticides used in the U.S. Over 97 percent of rural America's drinking water is estimated to come from underground sources. Also, about 40 percent of the population served by public water systems relies on groundwater. It is estimated that nearly one-fourth of the U.S. population relies on groundwater pumped from areas with a combination of significant agricultural chemical use and aquifers that may be vulnerable to contamination due to hydrogeologic characteristics (4).

The extent and degree to which groundwater resources contain agricultural chemicals are unknown. No national data base on pesticide or nutrient levels in groundwater exists. The Environmental Protection Agency (EPA) will carry out a national survey of pesticides in drinking water from groundwater sources beginning this fall. Forty-one agricultural pesticides with potential for leaching into groundwater will be looked for in the survey. Twelve have already been found in well water samples in some areas. Individual States are also initiating groundwater monitoring programs to assess the potential danger to these resources.

Water Quality Laws and Agricultural Pollution

Laws to protect ground and surface water resources may affect agriculture. The Water Quality Act of 1987, which amends the Clean Water Act, establishes a National Non Point Source Pollution Program. Under the Act, each State must report to the EPA those navigable waters which cannot attain or maintain water quality standards without reducing agricultural and other non-point source pollution. The report must also identify the particular non- point pollutants and their sources, the best management practices for controlling them, and State and local programs to achieve control.

Each State must then submit for EPA approval a management program for controlling the problem. The program can include nonregulatory and regulatory

enforcement, technical and financial assistance, education, training, technology transfer, and demonstration projects. It is significant that regulatory control of land uses, including agricultural, for protecting surface water quality is to be explored by the States.

The Act authorizes appropriations of $400 million during 1987-91. States can use the grants to help control particularly difficult or serious non-point source problems and to implement innovative methods.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), empowers the EPA to prevent any "unreasonable adverse effects" on people or the environment from pesticide use. If a pesticide poses a risk because of its potential effects on human health and its persistence in the environment, or its ability to leach through the soil profile, the EPA may act to temporarily suspend or permanently cancel its use. The pesticide DBCP was banned from all agricultural uses after it was found in wells in California and other States, following use on fruit and vegetable crops. Other pesticides, such as simazine, cyanazine, and aldicarb, have been restricted or locally banned because they leached into aquifers and presented a human health risk.

The Safe Drinking Water Act is intended to protect ground water. States are to develop programs preventing contamination of groundwater around public wells. One of the goals is to gain control over sources of contamination such as agricultural chemicals and animal waste. This may have significant implications for the use of agricultural chemicals in areas designated as critical. For example, Kansas recently passed the Chemigation Safety Act to minimize the pollution threat from using agricultural chemicals in center pivot irrigation systems.

Costs of Meeting Water Quality Goals

Protecting surface and groundwater quality by controlling non-point sources of pollution could have important economic impacts on agriculture at both local and national levels. The initial effect will be on the farmer. Banning or restricting certain pesticides to protect drinking water supplies may force farmers to shift to other pest control alternatives which are more expensive or less effective. Also, farmers may adopt different cultural practices in response to restrictions which may also affect production costs and yields. The abrupt withdrawal of aldicarb from the market in New York created problems for potato growers who were hard pressed to find an adequate substitute to control the Colorado potato beetle. It was estimated that banning aldicarb in Wisconsin would have reduced potato yields by 15 to 25 percent (3). The loss of yields or the need to switch to other, more expensive and less effective pesticides could reduce farm income.

Limiting erosion could cause significant shifts in where and how erosive row crops, such as corn and soybeans, are grown. These crops could be replaced by less erosive, and less valuable, crops such as hay. Farmers may be forced to adopt best management practices for reducing soil erosion, such as conservation tillage and terraces. To meet nutrient reduction goals, limits on fertilizer use and a fertilizer tax have been discussed. Any of these actions may reduce farm income if yields decrease or production costs increase. Rural economies may be hurt if much of the agricultural production in an area operates under restrictions.

At the national level, widespread changes in agricultural production could affect the market prices of crops. For example, the triazine herbicides, widely used on corn, will be looked for in the EPA survey of pesticides in well water. If these pesticides were banned, corn yields would decrease by an estimated average of 8 percent, raising prices about 31 percent (5). Farmers may benefit from increased prices, but the cost to consumers would be greater.

However, it is difficult to say what the ultimate impacts of water quality laws will be on agriculture. There are currently a variety of soil conservation programs which could improve water quality. The 1985 Food Security Act contains conservation measures which will significantly reduce soil erosion and agricultural residuals reaching waterways. The Act includes the Conservation Reserve Program, Conservation Compliance, Swampbuster, and Sodbuster provisions. If these provisions are successful in improving or protecting water quality, the need for other controls on soil erosion will be lessened. Even

if regulations are adopted, it is likely that they will be focused on critical areas, rather than over wide regions. Individual farmers and local economies would therefore bear most of the costs of meeting water quality goals. Only by banning or restricting the use of important pesticides, or by restricting erosion on a large portion of the Nation's cropland, would there be widespread impacts on production and prices. Whether such actions occur will depend on how successful current laws and soil conservation programs are in improving and protecting water quality, and on what the Nation is willing to pay to achieve these goals.

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AN ECONOMIC PERSPECTIVE OF SOIL CONSERVATION POLICY

by

R. Strohbehn and K. Alt

Abstract: Soil conservation depends on a complex set of supply and demand factors that are driven by resource endowments, technology, commodity policies, environmental preferences, international trade, and domestic economic conditions. Based on our assessment of these factors, (1) the land base appears adequate to meet future food and fiber demands; (2) significant soil productivity losses are occurring on only 20 percent of the cropland; (3) offsite damages from erosion outweigh soil productivity losses by 2 to 1; and (4) the payoff to conservation funds will be more cost-effective as they are directed to soils where the joint net benefits of protecting soil productivity and reducing offsite damages are highest.

Keywords: Soil erosion, soil productivity, environmental damage, conservation policy.

The Food Security Act of 1985 has been hailed as the most significant soil conservation legislation since the 1930's. Conservation and environmental quality goals were elevated to a level comparable to price and income supports to producers. In many respects, the debate about conservation policy and the design of specific conservation programs has become more complex over time. In addition to the integration of conservation and farm commodity policies, economic factors that drive conservation decisions are more crucial, and new information is available about the impacts of conservation decisions on soil

productivity and offsite damage. Several specific changes have resulted that could affect the perception of how much soil conservation is needed and the means of achieving conservation goals. Conservation goals have been broadened; excess capacity in agriculture has been increasing and lessens the need for full utilization of land and water resources; farmers are using less erosive tillage practices; and offsite damages due to erosion appear to be larger than onsite productivity losses. This article reviews these interacting forces and identifies some implications for soil conservation policy.

Conservation Policy Setting

Soil conservation has traditionally been considered a desirable stewardship goal, worthy of pursuing on its own merit. Public and private interests have been treated as the same, with public assistance provided to educate and encourage farmers to undertake conservation actions. The environmental movement in the 1960's brought a growing realization that conservation is not an end in itself, but rather a means to ensure a productive agricultural base for future generations and to reduce the environmental (offsite) damages from agricultural production practices.

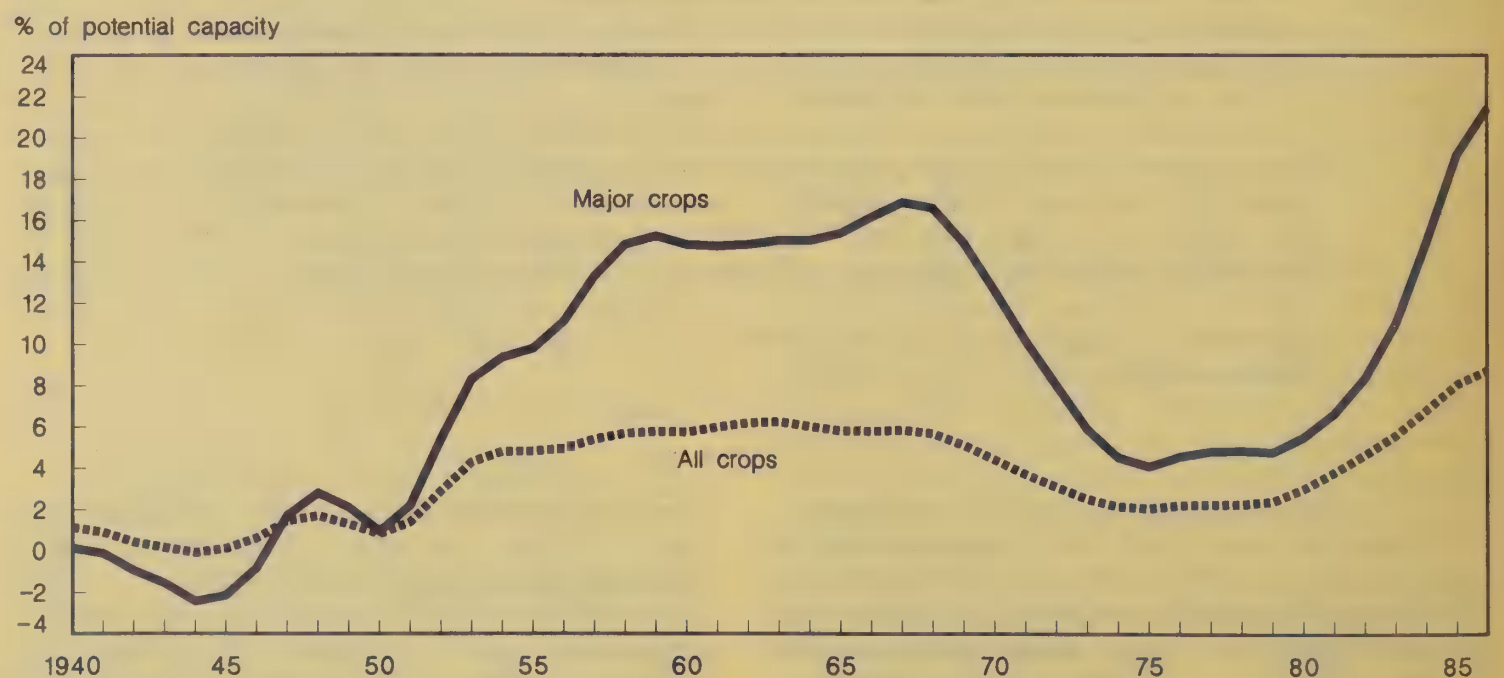
We have learned that public and private interests in resource management are not always the same. Three potentially conflicting goals now affect soil conservation policy: (1) shortrun income objectives of agricultural producers, (2) protection of the agricultural resource base for future generations, and (3) reduction of offsite damages from agricultural activities.

Economic Forces Shaping Conservation

Economic conditions affecting agriculture greatly influence farmers' conservation decisions and public conservation policy. Agriculture has faced a chronic problem of excess capacity since World War II, and the magnitude appears to be increasing (figure 1) (2). Major contributing factors to this excess capacity include rapid growth in new technology; increased investment in new equipment by farmers trying to remain competitive; slow growth in domestic and international demand for agricultural commodities; price support programs; and resource development. 3/ Excess capacity

3/ Excess capacity is the difference between potential supply and commercial demand at prevailing prices. Potential supply is actual production plus possible production from diverted acres.

Figure 1
Long-Run Excess Capacity



7-year moving average. 1985 preliminary.
Source (1).

decreased during the 1970's due to a temporary increase in international demand. This demand increase coincided with the renewed interest in soil conservation and a fear that longrun productive capability was being jeopardized for shortrun economic gain. Agricultural productivity has increased 2 percent a year since 1948, and there are indications that the biotechnology research underway now could maintain or accelerate this growth and contribute to even greater capacity in the future (8). If this growth in capacity is not matched by expanded demand, this would lessen the importance of conservation as a means to protect future productive capacity.

A major economic factor affecting conservation has been the commodity- price support programs of USDA. These programs had maintained crop prices above market clearing levels by restricting the number of acres that can be devoted to specified crops, by providing nonrecourse crop loans, and through export subsidies. High prices stimulate investment in agriculture and more intensive production on land actually devoted to crops, further contributing to the excess capacity problem. In addition, the cropland set-aside feature of the commodity programs creates an artificial land scarcity. Historically, the set-aside feature has resulted in a higher proportion of marginal, highly erodible land being used for crop production than would be the case without the programs. The Food Security Act of 1985 seeks to counter this effect through the conservation reserve and conservation compliance provisions.

Shortrun profit motives of farmers also affect soil conservation. Farmers continually seek to reduce their unit costs of production to remain competitive. They use conservation tillage to reduce labor and fuel costs and simultaneously reduce erosion. Because of the cost effectiveness, conservation tillage is now recommended as the primary means of erosion control. On the down- side, however, conservation tillage may lead to more pesticide use and may exacerbate contamination of surface and groundwater supplies.

Another economic factor affecting conservation policy is the Federal deficit. Effective use of conservation funds requires that they be used in a manner that achieves the highest level of conservation objectives. Consequently, efficient conservation program performance is especially important when agencies are under tight budget constraints.

Agricultural Productive Capacity

Adequacy of the Nation's land resources for future generations depends on population growth, international trade, technological and economic gains, consumer preferences, and conservation goals. The issue of conserving soil productivity needs to be examined within this broad context.

Soil Productivity Loss

New estimating procedures indicate that significant productivity losses from erosion are limited to a small acreage of vulnerable soils (4, 9). 4/ In contrast, there is a negligible productivity loss on a large portion of the Nation's cropland. Consequently, at the national level, productivity loss does not pose a large threat. If present levels of erosion continue for the next 100 years, crop yields could decline unless offset by yield-increasing technology. On a national average basis, these potential crop yield effects include: corn, down 4.6 percent; cotton, down 4.5 percent; soybeans, down 3.5 percent; and wheat, down 1.6 percent (1). These yield losses, combined with annual fertilizer losses, translate into an average annual loss of just over $1 billion.

4/ The estimation of soil productivity damages that are caused by erosion is not an exact science. This estimation process uses an estimate of current erosion multiplied by an estimate of the effect of erosion on crop inputs (fertilizer) and yields. Erosion effects differ not only by soil texture, slope and other physical determinants, but also by the nature of the crop grown, tillage, and by the rainfall amount and pattern. The aggregate estimates are based on the 1982 distribution of crops by region and soil. Erosion is defined here as all soil loss due to wind, sheet and rill erosion, but excluding ephemeral or gully erosion. We also need to clarify that the yield losses occur despite the fertilizer increases, which indicates that the yield decreases are due more to changes in the soil's water holding capacity than the removal of fertilizers by erosion.

Table 1.--Acreage losing crop yields if sheet, rill, and wind erosion continue for 100 years

Region	Percent of yield losses: under 2.0	2.0-7.9	8.0-24.9	over 25	Total acres
	million acres				
Northeast	8.3	4.8	3.8	0.3	17.2
Lake States	39.0	4.2	.8	-	44.0
Corn Belt	58.6	29.0	4.5	.3	92.5
Northern Plains	87.1	4.8	1.6	.3	93.7
Appalachia	11.8	8.0	2.1	.5	22.5
Southeast	14.9	2.9	.1	-	18.0
Delta States	18.8	2.6	.5	-	21.9
Southern Plains	44.1	.6	.1	-	44.8
Mountain	41.8	.6	.8	-	43.3
Pacific	20.6	1.3	.1	.7	22.7
United States 1/	345.2	58.8	14.5	2.2	420.6
Percent of total acres	82.1	14.0	3.4	.5	100.0

- = less than 50,000 acres. 1/ Totals may not add due to rounding. Computed from aggregate data.

Despite this dollar loss, the crop yield declines are small compared to the 100-percent growth in agricultural productivity from technological changes of the past 30 years.

About 80 percent of the cropland base (345 million acres) has negligible yield losses under current farming practices and erosion rates (table 1). This assumes that soils losing less than 2 percent of their crop yields after 100 years have an insignificant erosion problem, because of offsetting productivity gains in 1 year from technology. However, almost 20 percent of the cropland will lose 2 percent or more of its yields if erosion continues at present rates for 100 years. These are the acres that warrant special attention for intensive soil conservation action. The application of specific conservation practices, however, will depend on whether the benefits will exceed the costs. Two-thirds of the acres that lose more than 2 percent are located in the Northeast, Appalachian, and Corn Belt regions. And, over one-third of the cropland in each of these regions will lose at least 2 percent of its productivity.

An ERS study found that 40 percent of the cropland receiving public assistance for erosion control was eroding at only 5 tons per acre per year or less (6). Applying conservation practices to these acres provided a long-term productivity benefit of less than $2 per acre over the life of the practice, excluding offsite benefits. A related study found that the benefits per ton of erosion reduction vary widely among soils and regions across the country. Conservation tillage is a cost-effective erosion reduction practice in each of the four widely separated, high erosion rate study areas (7). Another study showed that conservation tillage would be more profitable than conventional tillage (plowing) on 74 of the 89 million most erodible cropland acres (9). Yet, conservation tillage by itself may not reduce erosion to acceptable levels on all acres.

Since significant soil productivity losses are limited to about one-fifth of the cropland, the USDA effort of directing funds to acres with high productivity losses and placing heavy reliance on low cost conservation tillage practices will increase the payoff to conservation programs. These acres are also leading candidates for enrollment in the Conservation Reserve Program.

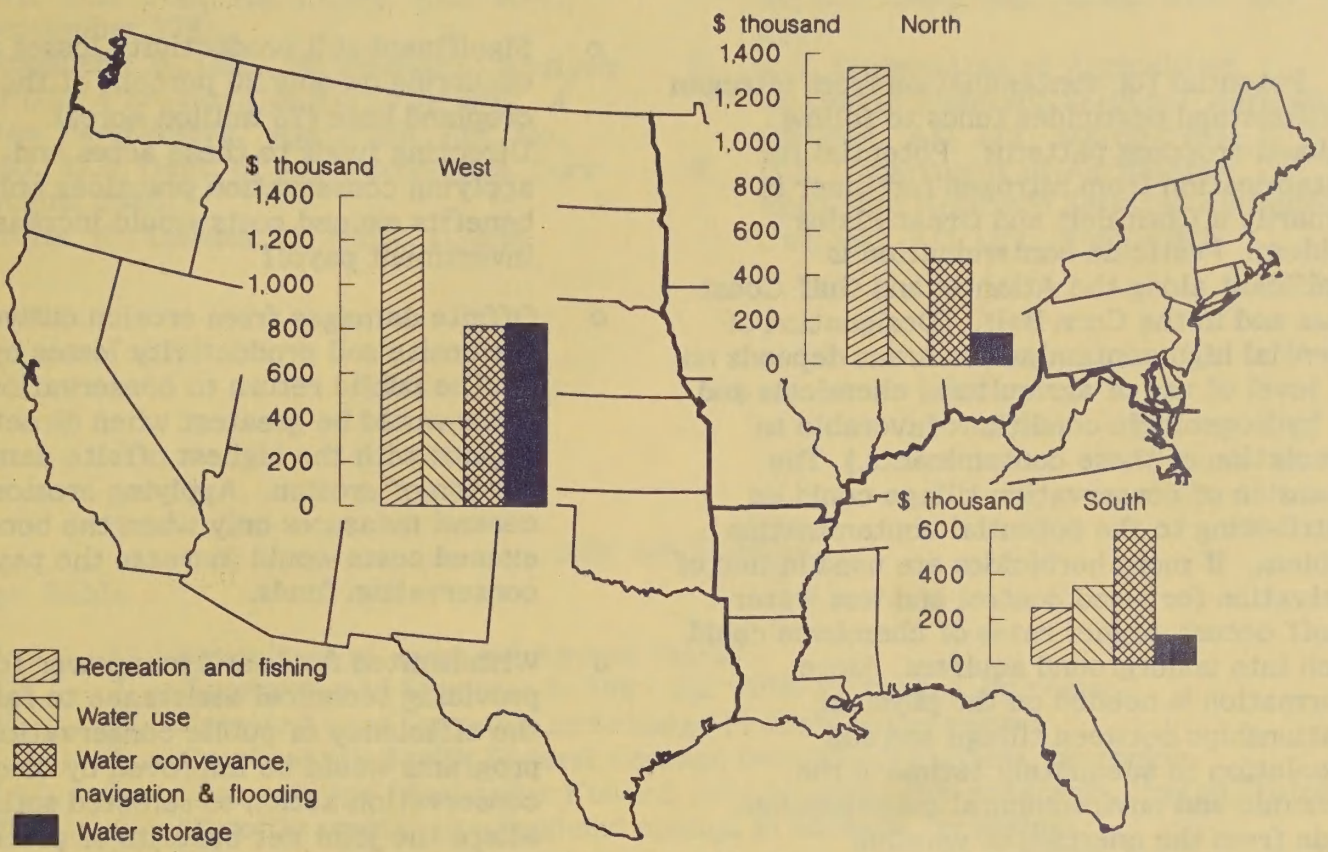
Environmental Benefits

Agricultural production activities can cause significant environmental damages. Knowledge of the extent and location of these damages is necessary to understand the effects of agricultural production decisions on the environment and to see how conservation and farm commodity policies can be more fully integrated.

Water Erosion Impacts

Sediment and agricultural runoff have long been recognized as inevitable byproducts

Figure 2
Offsite Damage from Water Erosion



Source (6).

of farming. Sediment and agricultural chemicals that are carried into the Nation's streams and waterways impose costs on subsequent water users or diminish the use of the water. Damaged will be water-based recreation, water storage and supply systems, and waterway transportation networks. Annual damages to these off-farm users from cropland erosion have been estimated to range from $2 billion to $6 billion, with an estimated mid-level of about $3 billion (5). This contrasts with the economic loss from declining productivity on eroding soils of just over $1 billion per year.

Offsite damage from erosion depends on both the amount of agricultural pollutants that get into the waterways and the types of offsite uses affected downstream. The importance of various "offsite users" affected by agricultural pollutants varies among regions. For example, recreation and fishing are the major activities affected in the North and West, while navigation and floodplain occupants are the major recipients of offsite damage in the South (See figure 2). Consequently, the value of offsite damage per ton of erosion varies among regions.

Offsite water quality damages from cropland erosion are about twice as large as soil productivity losses. The potential offsite benefits from reduced erosion are highest in the Northeast, Lake States, Delta States, and Pacific regions. These two observations imply that the social payoff to soil conservation programs would be enhanced by focusing more attention on reducing offsite damage and by directing funds where the damages per ton of erosion are the highest.

Groundwater Contamination

Underground aquifers supply water to over 50 percent of the people in the United States. There is growing concern about potential health risks resulting from agricultural chemicals leaching into aquifers. Pesticides and fertilizers receive special attention because of their toxic nature and widespread use. There are no specific estimates of health damage attributable to

these pollutants. The initial costs to detect pesticides and nitrates in private water supplies may total approximately $1.4 billion (3).

Potential for contamination from nitrogen fertilizer and pesticides tends to follow regional cropping patterns. Potential for contamination from nitrogen fertilizer is primarily a Corn Belt and Great Plains problem. Pesticide contamination is significant along the Atlantic and Gulf Coast areas and in the Corn Belt. (Designation of potential high contamination areas depends on the level of use of agricultural chemicals and the hydrogeologic conditions favorable to percolation of these contaminants.) The expansion of conservation tillage could be contributing to the potential contamination problem. If more herbicides are used in lieu of cultivation for weed control and less water runoff occurs, higher rates of chemicals could leach into underground aquifers. More information is needed on the physical relationships between tillage and soil percolation to adequately estimate the economic and environmental consequences. Aside from the question of whether conservation tillage is aggravating groundwater contamination problems, our findings imply that programs designed to reduce or mitigate the effects of nitrates and pesticides in water supplies should be directed to counties where the potential for contamination is highest.

Implications for Conservation Programs

Determining how soil resources should be used to produce what mix of consumer and environmental goods for current needs versus conserving them for future use is the crux of the conservation issue. Conservation of the Nation's soil resources depends on a complex set of supply and demand factors operating within a changing set of conditions defined by technology, commodity policies, environmental preferences, international trade, and domestic economic circumstances. As a result, conservation goals and prescriptions for action are continually in flux.

Here are some key conservation program considerations:

- The agricultural land base is adequate to meet foreseeable future demands for food and fiber.
- Significant soil productivity losses are occurring on only 20 percent of the cropland base (76 million acres). Directing funds to these acres and applying conservation practices only when benefits exceed costs would increase the investment payoff.
- Offsite damages from erosion outweigh the onsite soil productivity losses by 2 to 1. The public return to conservation funds would be greatest when directed to regions with the highest offsite damage per ton of erosion. Applying erosion control measures only when the benefits exceed costs would increase the payoff to conservation funds.
- With limited funds and manpower for providing technical assistance to farmers, the efficiency of public conservation programs would be improved by directing conservation action to selected soils where the joint net benefits of protecting soil productivity and reducing offsite damages are highest.

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